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Moutia (L. A.). **Notes sur le cycle biologique de trois lépidoptères nuisibles à la canne à sucre à Maurice.**—*Rev. agric. Maurice* **33** no. 3 pp. 116–122, 1 ref. Port Louis, 1954.

The moth borers that attack sugar-cane in Mauritius are *Proceras sacchariphagus* Bojer (spotted borer) [*cf. R.A.E.*, A **30** 474–476], *Sesamia calamistis* Hmps. (pink borer) [*cf.* **41** 68] and *Argyroploce schistaceana* (Sn.) (white borer), and observations are recorded on their bionomics [*cf.* **22** 259, etc.]. During rearing of *P. sacchariphagus* in the laboratory, the durations of the egg, larval, prepupal and pupal stages averaged 6, 61, 2 and 15 days in summer at an average temperature of 20–23°C. [68–73·4°F.], and 9, 75, 3 and 18 days in winter at 17–19°C. [62·6–66·2°F.]. The minimum and maximum durations of development from egg to adult were 61 and 120 days, respectively, and there were 4–5 generations a year. Only about 20 per cent. of the larvae that hatched in the field completed their development, the reasons for this low figure including destruction by predators (spiders, the ant, *Pheidole megacephala* (F.), and the earwig, *Chelisoches morio* (F.)) and heavy rain showers. About 15–20 per cent. of the canes that showed signs of attack were still infested by larvae or pupae when they reached the factories, and the mechanical destruction of these individuals afforded a valuable reduction in population.

When *S. calamistis* was reared at the same temperatures, the egg, larval, prepupal and pupal stages averaged 6, 47, 1 and 12 days, respectively, in summer and 10, 74, 2 and 16 days in winter. A minimum of 5, 31 and 8 days was required for the egg, larval and pupal stages, respectively, and a maximum of 18 days for the egg stage and 24 for the pupal stage. There were at least five overlapping generations a year. The percentages of dead hearts caused by this borer ranged from 20 to 60, averaging 35, in October–May, and 16 to 22, averaging 19, in June–September.

The egg, larval and pupal stages of *A. schistaceana* lasted 7, 32 and 11 days, respectively, in February–March, so that there are probably at least six generations a year. Attack is sometimes severe in March–May on the high plateaux, and up to 70 per cent. dead hearts have been observed in these months, with an average of 40 per cent.

Finlayson (D. G.) & Handford (R. H.). **Experiments on Control of the Onion Maggot, *Hylemya antiqua* (Meig.), in the Interior of British Columbia.**—*Canad. J. agric. Sci.* **34** no. 4 pp. 385–388, 4 refs. Ottawa, 1954.

Until 1950, a seed dressing of mercurous chloride (calomel) was the control measure in general use against *Hylemyia antiqua* (Mg.) on onion in the interior of British Columbia. In 1948, however, severe infestations were not satisfactorily controlled by this method and since mercurous chloride was costly and losses on untreated crops heavy, the value of organic insecticides applied in various ways was investigated in 1950 and in more detail in 1951. The seed was sown at the rate of 5 lb. per acre, and the effectiveness of the treatments was assessed from the number of seedlings that emerged, the amount of damage sustained between germination and harvest, and the yield of marketable onions.

A suspension of 25 per cent. wettable lindane [almost pure γ BHC] applied at 3 lb. toxicant per acre to the emerging seedlings and the soil, and again after ten and 20 days, resulted in significantly higher yields than any other treatment, gave satisfactory protection from *H. antiqua* and permitted good seedling emergence, but was costly and laborious to apply; there was some indication in 1950 that it might injure the seedlings under some

conditions [*cf. R.A.E.*, A **36** 90, 156]. Of various seed dressings, 50 per cent. wettable aldrin or dieldrin, both at 0·05 lb. per acre, resulted in higher yields and better seedling emergence than mercurous chloride at 5 lb. and 50 and 97 per cent. wettable DDT at 2·5 and 2·4 lb. per acre, respectively, but neither gave satisfactory protection from attack. However, in view of the low rates at which they were used, they are considered to show promise. DDT did not give significantly higher yields at either rate than did mercurous chloride, but resulted in significantly less damage at both and permitted the emergence of significantly more seedlings at the higher one. In the preliminary tests, 50 per cent. wettable DDT did not differ significantly from mercurous chloride on any criteria; it was, however, tentatively recommended to growers, who experienced some difficulty in obtaining uniform flow of the treated seed, but considered that this was offset by the lower cost and increased protection obtained. A dust of 1 per cent. parathion applied to the seed drills at 1 lb. per acre with the seed gave satisfactory protection, but caused a significant reduction in the number of seedlings and did not significantly increase the yield. Emulsified solutions of aldrin, dieldrin, chlordane or DDT applied to the drills prior to sowing gave excellent protection but impaired germination to such an extent that the yield was below that from the untreated controls; this was probably caused by the solvent.

Weatherburn (A. S.) & Bayley (C. H.). **Mothproofing Wool with DDT.** —*Soap & chem. Spec.* **30** no. 9 pp. 141–144, 163, 165, 167, 1 fig., 6 refs. New York, N.Y., 1954.

As DDT has recently become available in the form of water-dispersible concentrates suitable for use in laundry operations, investigations were made of the possibility of applying it in this form during the laundering of woollen materials and of the resistance of the treated wool to attack by the webbing clothes moth [*Tineola bisselliella* (Humm.)]. The DDT preparations tested were two commercial emulsion concentrates containing about 25 per cent. DDT in a suitable solvent with a non-ionic emulsifying agent, both of which emulsified spontaneously when mixed with water, and the detergents used were soap, two synthetic anionic preparations of the alkyl aryl sulphonate and sodium alkyl sulphate types and a non-ionic alkyl aryl polyethylene oxide condensation product.

Laboratory tests in which DDT content was determined chemically showed that woollen cloth (scoured unbleached flannel) treated with dilute aqueous emulsions of either DDT preparation retained much more of the compound than could be accounted for by the amount of liquid remaining in the wool; it is not known whether this was due to adsorption of the DDT or to filtering out by the wool of the comparatively large oil droplets of the emulsion. The pick-up of DDT was comparatively rapid, taking place largely within the first five minutes of the treatment period. It was much more rapid from one preparation than from the other, so that, for a short treatment period, the total taken up from the former was considerably the greater, but with longer periods of treatment (up to 40 minutes) there was less difference between the two products. Either would probably prove satisfactory, a slightly higher initial concentration of DDT or a longer treatment time possibly being required for the second; it is desirable to keep the treatment period to a minimum to avoid felting of the wool. When DDT was applied with the solution of detergent, it substantially reduced the amount of lather formed and the pick-up of DDT was reduced; deposition of DDT on the cloth and its removal owing to the action of the detergent probably take place simultaneously, so that the more efficient the detergent, the less the

DDT retained by the cloth. More DDT was retained when it was applied in the first rinse, and more still in three of five cases when it was applied in the second rinse. It therefore appears preferable to add the DDT after the bulk of the detergent has been removed by rinsing, and the rapidity with which non-ionic detergents can be so removed renders them particularly suitable for the laundering of wool before treatment with DDT. Repeating the treatment three times resulted in no increase in DDT deposition, indicating that the insecticide was readily removed by subsequent washing with detergent, but it was not removed by rinsing with water only. When DDT was applied in the second rinse after washing with soap, at the rate of 0·3 per cent. of the weight of the wool (about 5·5 ml. concentrate per lb. wool), 49 and 36 per cent., respectively, of the two preparations was removed from the bath, resulting in 0·15 and 0·11 per cent. DDT in the treated cloth.

In tests on a commercial scale, in which samples of cloth pinned to blankets were treated and subjected to attack by larvae of *T. bisselliella*, the average loss in weight and visible damage due to insect feeding and the number of larvae surviving being used to evaluate the treatments, DDT applied at 0·2 per cent. of the weight of the blankets (3·63 ml. concentrate per lb. wool) gave adequate protection. It proved essential to emulsify the concentrate in water before adding it, and when this was done, the DDT was found to be uniformly distributed throughout the load.

Limited tests were made with an aqueous emulsion containing 10 per cent. DDT stabilised with a cationic emulsifying agent, but the conditions necessary for its successful application are considered too exacting to make it suitable for commercial laundry use.

Olomucki (E.) & Bondi (A.). **Problems connected with Ethylene Dibromide Fumigation of Cereals. I. Sorption of Ethylene Dibromide by Grain.** —*J. Sci. Fd Agric.* **6** no. 10 pp. 592–600, 3 graphs, 15 refs. London, 1955.

Bondi (A.), Olomucki (E.) & Calderon (M.). **II. Feeding Experiments with laying Hens.**—*T.c.* pp. 600–602, 1 ref.

Ethylene dibromide is used in Israel for the fumigation of stored grain, but the feeding of laying hens with the fumigated grain was followed in several instances by a gradual diminution in the size of the eggs, and in extreme cases by the cessation of egg production. The first part of this paper contains the results of tests on the influence of different treatments on the amounts of ethylene dibromide sorbed and its reaction with the constituents of various cereals and on the effect of aeration on the removal of the fumigant. The total bromine present in the fumigated grain was found to occur partly in the form of free ethylene dibromide and partly in a non-volatile residual bromide resulting from the reaction of the fumigant with grain constituents. When the grain was fumigated with ethylene dibromide at 200 mg. per litre, the total bromine sorbed increased greatly in the first 48 hours of fumigation and tended to reach a constant value after 96 hours; residual bromine did not exceed 10 per cent. of total bromine. The amounts of ethylene dibromide taken up by whole grain during fumigation depended on the cereal and were smaller in barley and wheat than in sorghum and maize, whereas those taken up by milled grain were proportional to the specific volume and greatest for milled barley and least for milled sorghum; it is therefore concluded that the sorption is mainly physical in character. The amounts of residual bromide were not markedly influenced by the moisture content of milled grain but were greatly increased by high temperature, indicating that the reaction with grain does not

involve hydrolysis and is more vigorous at high temperatures. The reaction was found to be mainly with the protein fraction of the grain.

The airing experiments showed that the free ethylene dibromide evaporated rapidly from the milled grain in the first 48 hours and had disappeared after 15–18 days, whereas it did not disappear from whole grain for 45–48 days. The residual bromide increased during the first five days of airing in milled grain and during the first 14–17 days in whole grain, but was relatively low in all the cereals tested. Under normal fumigation conditions in silos, volatile bromide disappeared after airing for 6–7 weeks.

The second part comprises an account of feeding experiments with laying hens. The results showed that hens fed daily with 50 gm. standard ration and 50 gm. sorghum containing 10 or 15 mg. free ethylene dibromide ceased laying after 56 and 46 days, respectively, and did not resume laying when given bromine-free food, even after several months. A content of about 3 or 5 mg. free ethylene dibromide resulted in a progressive reduction in the number and weight of the eggs laid after 3–9 weeks. Contents of 0·5 and 1 mg. free ethylene dibromide caused a significant slight diminution in egg size after about 12 and 8 weeks, respectively, and subsequent feeding with uncontaminated grain resulted in a return to normal egg size in 3 and 6 weeks; the number of eggs laid was not affected. Sorghum containing no free ethylene dibromide but 6 mg. residual bromide per 50 gm. had no effect on egg size or number, showing that grain that has been sufficiently aired can safely be fed to poultry. As feeding with grain containing 0·5 mg. free ethylene dibromide per 50 gm. for 2–3 weeks did not affect the birds, this amount is considered permissible for practical use. Farm grain containers are not hermetically closed, and such small quantities of fumigant would evaporate in that time.

Muthu (M.) & Pingale (S. V.). **Control of Insect Pests in Grains stored in Insecticide-impregnated Jute Bags.**—*J. Sci. Fd Agric.* **6** no. 10 pp. 637–640, 9 refs. London, 1955.

As storage in jute bags impregnated with insecticides has been shown to protect grain from insects entering from outside but not to control completely those already in the grain, the effects were tested in India of injecting various fumigants into sorghum that had been infested with *Calandra oryzae* (L.), *Rhizopertha dominica* (F.) or *Tribolium castaneum* (Hbst.) three months earlier and stored at 82–88°F. and 50–60 per cent. relative humidity in 200-lb. jute bags impregnated with lindane [almost pure γ BHC] but not made airtight. When the bags were laid horizontally on the ground and 10, 20 or 30 cc. methyl bromide, acrylonitrile, carbon tetrachloride or ethylene dibromide or the same amounts of a mixture of ethylene dichloride and carbon tetrachloride (3:1) injected into the centre, examination after seven days showed that only ethylene dibromide gave effective control. When 5, 7·5 or 10 cc. ethylene dibromide was injected centrally into vertical bags four inches down from the top and into horizontal bags in the centre or in two equal parts one foot on either side of the centre, examination seven days later showed that a dose of at least 10 cc. was necessary to kill all the insects, but that the position of the bags and point of injection had little effect on mortality. In bags that had not been impregnated, all the insects found seven days after the treatment of horizontal bags with 10, 15 or 20 cc. ethylene dibromide were dead, but these accounted for not more than 83 per cent. of the original populations, and another test showed that 38–59 per cent. of the adults that escaped from bags that were fumigated but not impregnated could breed under favourable conditions

whereas those escaping from impregnated bags did not breed and soon died.

In stacks of 125 bags, a dose of 7·5 cc. ethylene dibromide injected into the centre of each bag was found to be sufficient for complete mortality in impregnated bags, and only insects found on the outside of similar piles of fumigated bags that had not been impregnated were alive; these could be killed by surface treatment, so that impregnation may be unnecessary if the bags are treated with ethylene dibromide and then stacked. Examination of grain samples taken from treated stacked bags at three-day intervals showed that the chemical was retained longer in bags at the bottom or inside of the stack than in the outside ones. Samples of hard wheat, sorghum and unpolished rice that were removed seven days after treatment with 20 cc. ethylene dibromide per bag or after exposure for a month to 120 mg. per litre under airtight conditions, and aerated for four hours at 78–82° F. were found to contain 12–31 parts per million ethylene dibromide, which is not considered harmful.

Blanck (A.), Miquel (L.) & Motemps (J.). **Premiers essais d'efficacité comparée des nouveaux acaricides dans la lutte contre l'acariose bronzée de la tomate.**—*Phytoma* 7 no. 63 pp. 5–9, 2 figs., 1 graph, 6 refs. Paris, 1954.

There has in recent years been a considerable increase in the cultivation of tomatos for canning in the lower Rhône Valley, and severe infestation by *Vasates lycopersici* (Massee), a mite that was previously unknown in France, was observed there in 1952–53. In 1954, field experiments were begun on its control, though in that year the attack occurred much later than usual (the first injury being observed on 28th August), was localised, and did not greatly reduce the yield.

Excellent results were given by a late spray of micronised sulphur applied just before severe symptoms of attack developed on the leaves, while the foliage on untreated plants dried up completely, but it is not yet known whether sulphur is safe for use on fruits for canning, in view of its possible reactions with the metal containers. In a second test, sprays of 0·125 per cent. malathion, 0·038 per cent. Chlorobenzilate [ethyl 4,4′-dichlorobenzilate] and 0·4 per cent. micronised sulphur were applied on 1st September. Three days later, the numbers of *Vasates* per sq. cm. of leaf were 104, 331 and 11, respectively, as compared with 336 on untreated plants. Though these figures have no absolute value, owing to difficulties in counting such small organisms and the migration of the mites to the leaves in the best condition, they are held to indicate that Chlorobenzilate does not give rapid control. In a third test, on plants that had already been treated with sulphur to control the infestation that began on 28th August, sprays of 0·15 per cent. malathion, 0·06 per cent. PCPCBS [p-chlorophenyl p-chlorobenzenesulphonate], 0·038 per cent. Chlorobenzilate and 0·4 per cent. micronised sulphur were applied on 8th and 27th September. After the second application, the numbers of mites per sq. cm. of leaf were 89, 2·2, 8·7 and 4·8, respectively, as compared with 0 for no treatment, the leaves being well or fairly well preserved on plants that received the first three materials and in a poor or very poor condition on the others. The yield per plot at the last picking was 191·8 lb. for malathion, 138·9 lb. for PCPCBS, 123·5 lb. for Chlorobenzilate and 116·9 lb. for sulphur, as compared with 110·3 lb. for no treatment. In a fourth test, sulphur, Chlorobenzilate, PCPCBS and malathion were applied on 20th and 31st July and 11th August. Infestation had not developed by 11th August, but was

severe from mid-September, and untreated plants rapidly dried up. The treated plants remained in good condition, and yielded about 4·4 lb. per plant, as compared with 3·3 lb. for no treatment. In addition to reducing the yield, the attack reduced the size of the tomatos and accelerated ripening.

Schvester (D.) & Milaire (H.). **Problèmes de la lutte contre la cochenille du mûrier.**—*Phytoma* 7 no. 63 pp. 20–23, 1 fig. Paris, 1954.

The authors recapitulate the results obtained with winter sprays against *Pseudaulacaspis* (*Sasakiaspis*) *pentagona* (Targ.) on peach near Lyons in 1952 [*R.A.E.*, A **43** 27] and describe further experiments in 1954, in the first of which heavily infested trees were sprayed (before pruning) on 24th February and mortality was recorded about five weeks later. All the products tested, except one, were applied at 3 per cent., and unless otherwise stated they were of the mayonnaise type. The mortality percentages were 60·6 for a product containing 80 per cent. mineral oil, 53·6 and 64·6 for two containing 80 per cent. mineral oil and 1·5 and 3 per cent. parathion, respectively, 74·2–84·9 for one containing 75 per cent. mineral oil and 5 per cent. DNC, 87·2 for the same product at 4 per cent., 80·4 for a product of the soluble-oil type containing 90 per cent. mineral oil and 5 per cent. DNC, and 76 for a similar product containing 95 per cent. mineral oil and 3·3 per cent. DNC, as compared with 44·1 for no treatment.

In a second test, a product of the mayonnaise type containing 75 per cent. mineral oil and 5 per cent. DNC was applied at various concentrations, with or without the addition of further DNC, on 2nd March. The mortality percentages were 89·75 and 98·2 for 3 and 4 per cent., respectively, of the product alone, 75 and 88·75 for 2 and 3 per cent., respectively, of the product with the addition of 0·05 per cent. DNC, and 84·75 for 2 per cent. of the product with the addition of 0·1 per cent. DNC, as compared with 60 for no treatment. Techniques for applying winter sprays against Diaspines are briefly discussed.

Pineau (J.). **Essais de traitements contre la teigne de la carotte dans la Vienne.**—*Phytoma* 7 no. 63 pp. 27–28. Paris, 1954.

In 1953, the flowers of carrot grown for seed near Poitiers were webbed together and destroyed by larvae of *Depressaria apiella* (Hb.) (*nervosa* (Haw.)), but satisfactory control was given by a spray of DDT and white oil. In 1954, the crop was sown on 1st March, and adults and eggs were present on 31st May. Sprays, all at 90 gals. per acre, were applied on 2nd June (when there was an average of two larvae per plant), and again on 9th and 19th June. There was little difference in infestation between the treated and untreated plants after the first application, but the mortality percentages after treatment on 9th and (in brackets) 19th June were 50 (75), 75 (80) and 75 (85) for 0·015, 0·025 and 0·05 per cent., respectively, of a product containing 19 per cent. endrin, 75 (85) for 1 per cent. of a product containing 10 per cent. DDT and 3·5 per cent. lindane [almost pure γ BHC], and 95 (80) and 96 (93) for 0·5 and 1 per cent., respectively, of a product containing 10 per cent. DDT and 61 per cent. white oil, as compared with 0 (0) for no treatment. The yield of seed in lb. per 20 plants was about 1·76, 1·87 and 1·87 for the three endrin sprays, respectively, 1·65 for the mixture of DDT and lindane, and 1·87 and 1·98 for the sprays of DDT

and white oil, respectively, as compared with 1·65 for no treatment. The cost of spraying is briefly discussed and shown to be economic.

DELMAS (H. G.). **Le vespère de la vigne. Techniques de lutte.**—*Rev. Zool. agric.* **53** no. 7–9 pp. 110–120, 6 figs., 5 refs. Talence, 1954.

The larvae of the Cerambycid, *Vesperus xatarti* Duf., are serious pests of vines in the French Department of Pyrénées-Orientales, especially on the slopes along the southern part of the coast; aerated, flinty or sandy soils appear to be preferred. The adults emerge from the soil between late November and February–March and survive for about a month but do not feed. The eggs are laid in batches in cracks in rocks or more frequently beneath the bark of the vines, at least a foot above the soil level, and the larvae hatch in March–May and enter the soil, where they feed on the roots of the vines, especially in spring and autumn, and damage them considerably in their later instars. In summer and winter, most of the larvae are below the level of the roots. Development in the soil probably lasts 3–4 years. The larvae are polyphagous, but vines are particularly attacked, especially young ones, many of these being killed. Older plants survive, but growth and yield are reduced.

Cultural and mechanical methods of control are briefly reviewed, and an account is given of experiments on chemical control carried out in three vineyards. In the first, which was on deep soil in the plain, BHC was incorporated on 15th November 1950 by hoeing into the soil in which the stocks were to be planted, so that each of these received 1, 3 or 5 gm. technical BHC applied over about a sq. yard. By 23rd November 1951, about one third of all the plants had died, whether treated or not, largely owing to causes other than attack by *V. xatarti*. Of the dead plants, those that had received 3 or 5 gm. BHC showed very slight injury by the Cerambycid, but injury was severe on those receiving 1 gm. or none. Treatment of a few stocks at the rate of 10–15 gm. BHC per plant did not prevent injury at depths of about 16 ins., which are probably beyond the range of effectiveness of surface treatment, and many of the plants were killed by the BHC. A deeper distribution of the toxicant could be obtained by mixing it with the soil used to fill the planting holes.

In the second vineyard, in which the soil was about a foot deep, a 10 per cent. BHC dust was broadcast to give 18 lb. BHC per acre in late November 1950, before the stocks were planted. By mid-November 1951, 11 and 47 per cent. of the plants in treated and untreated soil, respectively, had died. In another part of the same vineyard, a 2 per cent. parathion dust was applied at 4·5 lb. toxicant per acre. After one year, 17 per cent. of the plants had died, as compared with 53 per cent. of those in an untreated area.

The soil in the third vineyard was flinty and shallow. The BHC dust was broadcast in November 1950 to give 18 lb. BHC per acre, and in November 1951, 10 and 48 per cent. of the stocks in treated and untreated soil, respectively, had died, mortality being due exclusively to the larvae of *V. xatarti*. The treatment was then repeated at 22·5 lb. BHC per acre, the dead plants being replaced by fresh ones. In November 1952, the greater part of the plants in the treated soil showed vigorous growth, as compared with only 39 per cent. of those in untreated soil, and the BHC dust was applied again, the dead plants being replaced. In November 1953, 28 per cent. of the stocks in the treated soil had developed to the point of being grafted, 53 per cent. showed vigorous growth, 14 per cent. were stunted and 5 per cent. were dead, as compared with 8, 24, 47 and 21 per cent., respectively, of those in untreated soil.

It is concluded that BHC is effective against the Cerambycid. To avoid an accumulation of harmful residues in the soil, it is recommended that after an application at 18–22·5 lb. per acre in the first year, the rate be reduced to 9–13·5 lb. in successive years, or that applications be made at two-year intervals.

SCHVESTER (D.). **Essais complémentaires de formules insecticides d'hiver contre certaines cochenilles diaspines.**—*Rev. Zool. agric.* **53** no. 7–9 pp. 121–125, 5 refs. Talence, 1954.

The results are given of further experiments with winter sprays for the control of *Quadraspidiotus perniciosus* (Comst.) and *Epidiaspis leperii* (Sign.) [*cf. R.A.E.*, A **42** 341] carried out on pear near Lyons in 1954. In the test against *Q. perniciosus*, sprays were applied to nursery stock on 12th February, and mortality counts were begun on 27th March. The control percentages, calculated according to Abbott's formula [**13** 331], were 99·8 for 3 per cent. of a white oil emulsion (summer oil) containing about 80 per cent. refined oil, 99·6 and 100 for 2 and 3 per cent., respectively, of a product of the mayonnaise type containing 75 per cent. oil and 2·5 per cent. DNC, 98·8 and 100 for 2 and 3 per cent., respectively, of a similar product containing 75 per cent. oil and 5 per cent. DNC, 92·7 and 100 for 2 and 3 per cent., respectively, of a product of the soluble type containing 90 per cent. oil and 5 per cent. DNC, and 84·9, 96·5 and 100 for 1·5, 2 and 3 per cent., respectively, of a similar product containing 95 per cent. oil and 3·3 per cent. DNC. An experimental oil concentrate containing 80 per cent. normal (straight-chain) paraffins proved ineffective.

In the test against *E. leperii*, the first three products and the last, each at 4, 5 and 6 per cent., were applied on 23rd February to severely infested trees. Mortality counts were begun on 18th April, and the control percentages, calculated in the same way, were 73·7, 84·8 and 98, respectively, for the first product, 77, 95·1 and 100 for the second, 99·7, 99·7 and 100 for the third, and 79·7, 92·8 and 94·3 for the last.

BALCELLS R. (E.). **Estudio ecológico de** *Haltica lythri* **subespecie** *ampelophaga*, **Guerin-Meneville (Col. Halticinae).** [An ecological Study of *H. lythri ampelophaga*.]—*Publ. Inst. Biol. apl.* **17** pp. 5–37, 1 fldg. pl., 2 figs., 9 graphs, 23 refs. Barcelona, 1954. **Sobre la distribución geográfica de** *Haltica lythri* **subespecie** *ampelophaga*, **Guerin-Meneville.** [On the geographical Distribution of *H. lythri ampelophaga*.]—*Op. cit.* **18** pp. 5–41, 8 maps, 81 refs. (With Summaries in English.)

In the first of these papers, a detailed account is given of investigations on the effect of temperature and humidity on the various stages of *Haltica lythri ampelophaga* Guér., which is injurious to grape vines in Spain [*cf. R.A.E.*, A **42** 341, etc.]. The eggs and larvae did not survive at temperatures above 32·5–33°C. [90·5–91·4°F.], the prepupae, pupae and adults died in a few hours at 35°C. [95°F.], and oviposition ceased above 32·5°C. Development was very slow at 8°C. [46·4°F.], and eggs kept for 20 days at that temperature hatched only after a further eight days at more than 22°C. [71·6°F.]; adults survived for at least 24 hours at −10°C. [14°F.]. It is concluded that complete development takes place between 10·5°C. [50·9°F.], the threshold of development for the eggs, and 32·5°C. A relative humidity of at least 70 per cent. was necessary for complete development at all temperatures, though prepupae and pupae kept at 15–25°C. [59–77°F.] developed normally at a relative humidity of not much more than 35 per

cent. The preoviposition period lasted 5–10 days and did not vary with temperature.

Hyperbolas are constructed according to the method of Blunck & Bodenheimer [**13** 389] to illustrate the effect of temperature on the duration of the egg stage, the egg and larval stages together, a complete generation from egg to adult and egg to egg, the larval stage, the larval and prepupal stages together, and the prepupal and pupal stages separately and together, but it is pointed out that the laboratory results, which were obtained at constant temperatures, are not directly applicable to the field, where temperatures fluctuate. The number of generations a year is discussed and is shown to be three in the field near Barcelona, though five were reared in the laboratory.

Since the annual cycle of the insect is dependent on that of its food-plant, the vegetative cycle of grape vines near Barcelona is described. Experiments showed that the age of the leaves provided as food had no effect on the time required for development. Leaves are available from early March to early December, so that the cessation of oviposition in autumn is dependent on temperature and not on absence of foliage.

In the second paper, the distribution of the vine-growing areas throughout the world is reviewed and shown on maps, the country of origin of *H. lythri ampelophaga* is discussed and shown probably to have been Spain, and a table based partly on unpublished sources is given showing the countries and the districts in them in which the Halticid occurs, with the respective annual isotherms and the isotherms for January, July, March–November and April–September. In addition to those recorded in the earlier literature, the countries include Portugal, the Azores, Belgium, Switzerland, England and Tunisia. From these records and a study of the annual, January and July isotherms, which are plotted on maps, the areas in which it is theoretically possible for the insect to survive and those in which it could become a pest are defined and shown on a further map. By relating the data recorded in the first paper on the duration of development at various temperatures to the six- or nine-month isotherms, it is possible to calculate the number of generations that will occur in a year in a given area, and a map is given showing these for the parts of Europe and North Africa in which the insect occurs. Corrections must be made for altitude, and this is done by reducing the number of generations by one for every 1,760 ft. above sea level.

Grandori (R.) & Rota (P.). **Esperimenti di lotta con aldrin contro elateridi e maggiolino.** [Control Experiments with Aldrin against Elaterids and Melolonthids.]—*Boll. Zool. agr. Bachic.* **20** fasc. 1 pp. 3–26, 2 figs., 2 graphs, 6 refs. Milan, 1954. (With Summaries in French and English.)

In tests against *Agriotes lineatus* (L.) and *A. litigiosus* (Rossi) attacking maize in the Province of Novara in 1953, a dust containing 1 per cent. aldrin was applied to the soil at rates giving 1·8 and 3·6 lb. aldrin per acre, and one containing 2 per cent. γ BHC at 1·8 lb. γ isomer per acre, and harrowed in to a depth of 2–3 ins. immediately before sowing. In the first field, the wireworm population was considerable, and larvae of *Zabrus tenebrioides* (Goeze) were also present. Germination and plant growth were better, ear-formation more regular and the numbers of wireworms about the roots much lower in the plots dusted with aldrin than in those dusted with BHC or left untreated, and the yields of grain per acre were about 5,970 and 6,175 lb. for 1·8 and 3·6 lb. aldrin, 5,190 lb. for BHC and 4,285 lb. for no treatment. Infestation by *Byrsocrypta ulmi* (L.) (*gallarum* (Gmel.))

became severe on the control plot in the second half of August and increased somewhat on that treated with BHC, but was negligible on those treated with aldrin.

In the second field, larvae of *Agriotes* were less numerous but those of *Z. tenebrioides* were present in considerable numbers, and a fertiliser was applied in July, following a period of drought that stunted the plants. Infestation by *B. ulmi* was much lower than in the first field. The reductions in wireworm numbers were comparable to those previously obtained, and the yields per acre were about 5,300 and 5,570 lb. for 1·8 and 3·6 lb. aldrin, 5,010 lb. for BHC, and 4,150 lb. for no treatment.

Further tests were carried out in a nursery near Como, where the larvae of *Melolontha melolontha* (L.) had caused 40–80 per cent. mortality of the young plants annually. Two broods of the Melolonthid occur in that area, the adults of one of which (forming 5–10 per cent. of the population) appeared in 1952 and those of the other in 1953. In all tests, a dust of 2·5 per cent. aldrin was scattered on the soil and incorporated to a depth of 4–6 ins. by hoeing. When the dust was applied between rows of vine cuttings to give 1·8 lb. aldrin per acre and the cuttings were removed at the end of November, 20 per cent. of those in untreated soil were injured and 12 per cent. had been killed by *Melolontha*, as compared with 2 per cent. and less than 0·5 per cent., respectively, for treatment with aldrin. Similar treatment of *Araucaria* prevented any mortality by 4th December; considerable numbers of larvae were found in the soil a short distance from the treated area, but very few in it. Applications of the dust to give 0·9–1·35 lb. aldrin per acre similarly afforded complete protection of other young conifers, whereas there was 2 per cent. mortality among the controls by 4th December and some of the remaining plants showed signs of attack.

Grandori (R.) & Rota (P.). **Esperimenti di lotta contro la piralide del mais nel 1953.** [Experiments in 1953 on the Control of *Pyrausta nubilalis* attacking Maize.]—*Boll. Zool. agr. Bachic.* **20** fasc. 1 pp. 61–81, 15 refs. Milan, 1954. (With Summaries in French and English.)

Infestation of maize in Lombardy by *Pyrausta nubilalis* (Hb.) has greatly increased in recent years, and averages of 90–98 per cent. of the plants were attacked in 1951–53, with a maximum of 100 per cent., the numbers of larvae per stalk averaging 3·5–4. Hybrids introduced from the United States are particularly attacked [*cf. R.A.E.*, A **42** 249], the infestation percentages and (in brackets) average numbers of larvae per stalk in one area in 1952 being 90 (3·54) for a first-crop hybrid and 83 (2·67) for a second crop one, as compared with 73 (1·68) and 42 (0·54), respectively, for comparable Italian varieties. In 1953, the infestation percentages averaged 90 for the second-crop hybrid and 71 for an Italian variety. The greater infestation of the hybrids is thought to be due to their more luxuriant growth, longer vegetative cycle, and greater contents of moisture and sugar. The maize stalks are largely used in February–May for bedding cattle, and the trampling of the animals and subsequent fermentation in manure heaps and burying in the soil kill most of the larvae hibernating in them and thus afford a useful measure of control. The stalks of the hybrids are tougher than those of the Italian varieties and disintegrate less easily, so that most of the larvae survive. When such larvae were buried, all those at a depth of 4 ins. and 25 per cent. of those at 8 ins. gave rise to adults, but there was no emergence from a depth of 12 ins. It is estimated that 40 per cent. of the larvae initially present in the stalks would complete their development.

In view of the high yield of the hybrids, other methods of control were tested in 1953. The difficulties of applying insecticides in maize fields are discussed, chief among them being the impossibility of moving equipment among the plants once these have reached a height of about 4 ft. In tests, sprays were applied in three areas. In one, first-crop hybrid maize nearly 4 ft. high was sprayed from knapsack sprayers, and the percentage infestation and (in brackets) the number of larvae per infested stalk were reduced from 66 (2·1) for no treatment to 45 (1·2) by 0·03 per cent. γ BHC, 45 (1·5) by 0·075 per cent. aldrin, 55 (1·5) by 0·02 per cent. parathion and 58 (1·4) by 0·25 per cent. toxaphene. In the second area, sprays were applied on 19th June and 7th August to first-crop hybrid maize by means of a Buffalo turbine machine working from the edges, and the percentage infestation and (in brackets) the average number of larvae per infested stalk were reduced from 43 (1·9) for no treatment to 8 (1·2) for 0·125 per cent. DDT, 10 (1·1) for 0·25 per cent. toxaphene and 11 (1·4) for 0·02 per cent. parathion. The three insecticides increased the yield by 14, 12 and 7 per cent., respectively. At the time of the second treatment, the plants were 7–8 ft. high and the sprays could be applied only to swathes about 50 ft. wide, whereas most fields in the district have sides more than 100 yards long. In the third area, the parathion spray was applied by knapsack sprayer to second-crop hybrid and Italian varieties. The infestation percentages and (in brackets) the average numbers of larvae per infested plant were reduced to 77 (2) and 56 (1·3) as compared with 90 (2·4) and 71 (2·1) for no treatment.

In the autumn of 1952, the maize stalks in a field in which infestation had reached 75–80 per cent., with an average of two larvae per infested plant, were cut close to the ground to avoid leaving larvae in the stubble, and passed through a special chopping machine during the winter and early spring. This process destroyed 80 per cent. of the larvae, and the chopped and split stalks were then used in the normal way for cattle bedding and ultimately ploughed into the soil of the maize fields in spring. The infestation of first-crop maize in the area in which this method was followed was 10 per cent., as compared with 64–80 per cent. on neighbouring farms where the stalks had not been treated in this way. Apart from the consequent reduction in infestation, the advantages of chopping and splitting the stalks include easier handling, quicker fermentation and easier ploughing into the fields. The cost is considerably less than that of chemical treatments.

Nizamlioglu (K.). *Rhagoletis cerasi* **L. Böceğinin İstanbul ve Marmara bölgesinde biyoloji ve mücadelesi üzerine araştırmalar.** [*R. cerasi*. Researches on the Bionomics and Control of the Insect in the Districts of Istanbul and Marmara.]—67 pp., 11 figs., 5 pp. refs. Istanbul, 1954. (With a Summary in English.)

Rhagoletis cerasi (L.) causes serious injury to cherries in European Turkey and in the Marmara, Ege and Black Sea regions of Anatolia. All stages of this Trypetid and its distribution are described, and an account is given of its bionomics, based on the literature and on observations in 1952–53 in Turkey. These showed that the adults emerge from the soil in April or May, at soil temperatures of about 22°C. [71·6°F.] at a depth of about an inch, provided that drought conditions do not prevail. Development in the fruits lasts 15–30 days, and some of the pupae in the soil enter a diapause that lasts two years. The earliest cherries are not heavily attacked, but infestation of the late varieties ranges up to 100 per cent. The control of the fruit-fly in various parts of the world is reviewed from the

literature. In tests with sprays of organic insecticides, DDT and parathion gave the best results, 0·075 and 0·1 per cent. wettable DDT applied in May giving 98·25 and 98·62 per cent. control, respectively, as calculated by Abbott's formula [*R.A.E.*, A **13** 331], and 0·05 per cent. of an emulsion concentrate containing 35 per cent. parathion giving complete control.

Nizamlioglu (K.). **Recent Details on the Epidemiology of** *Eurygaster integriceps* **Put. and on the Epidemiology, Ecology of** *Eurygaster integriceps* **as well as on its Control in 1955 in the Districts of Diyarbakir/ Urfa.** (Abstract.)—*Tomurcuk* **4** no. 46 p. 6. Istanbul, 1955.

The author points out that *Eurygaster integriceps* Put. has been injurious to cereals in south-eastern Anatolia uninterruptedly for over 17 years, in spite of Zwölfer's conclusion that continuous infestation was unlikely [*cf. R.A.E.*, A **19** 301]. The climate of this region is not optimum for the Pentatomid, but cereals and wild grasses that serve as food-plants for it are constantly present over large areas, and egg-parasites [*cf.* **42** 277] are not numerous. In experiments in 1955 on control by sprays applied from aeroplanes, Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl thiophosphate] at about 3·5 lb. 20 per cent. emulsion concentrate per acre gave 85 per cent. kill of adults, and emulsion sprays affording about 0·35 lb. parathion per acre gave 80–95 per cent. kill of the nymphs.

Tuatay (N.). **Türkiyede ilk defa görülen bir bağ haşeresi**: *Antispila rivillei* **Stt.** [*A. rivillei*, a Vine Pest observed for the first time in Turkey.]—*Tomurcuk* **4** no. 46 pp. 14, 16, 1 fig., 4 refs. Istanbul, 1955.

Antispila rivillei Stnt., a well-known pest of grape vines in many Mediterranean countries, is recorded for the first time from Turkey, where it was recently observed mining the leaves. The adults and larvae of the moth are very briefly described, and its bionomics are summarised from the literature [*cf. R.A.E.*, A **22** 607].

da Fonseca (J. P.). **Emprêgo de inseticidas orgânicos no combate à cupins subterrâneos nocivos à mudas de eucalipto.** [The Use of organic Insecticides for the Control of subterranean Termites injurious to *Eucalyptus* Seedlings.]—*Arq. Inst. biol.* **21** pp. 13–19, 2 figs., 2 refs. São Paulo, 1954. (With a Summary in English.)

The results of earlier tests on the protection of *Eucalyptus* seedlings from attack by *Syntermes insidians* Silv. and *S. molestus* (Burm.) in São Paulo are summarised [*R.A.E.*, A **41** 252], and further experiments, carried out in 1948, are described. In the first of these, DDT applied at 1–3 per cent. in soil or in equivalent amounts in an emulsified solution proved ineffective. In the second, a BHC powder containing 0·45 per cent. γ isomer was mixed with a little road dust and incorporated at 2, 4 and 6 per cent. of the powder into the mixture of soil and stable manure that was packed round the seedlings in February, prior to planting out. In December, when the plants were examined, the percentages attacked were 23·75, 7·5 and 0 for 2, 4 and 6 per cent. of the powder, respectively, 7·5 for treatment with 3 per cent. arsenic trioxide and 41·25 for no treatment. The powder gave significant protection at 2 per cent., and that given by it at 4 and 6 per cent. and by arsenic trioxide was significantly better. There were no phytotoxic effects, and BHC at the highest concentration is therefore recommended. It can

be applied to the holes as previously described [*loc. cit.*] or incorporated into the blocks of compressed soil in which the seedlings are transplanted.

DA COSTA LIMA (A.). **Sôbre duas espécies do gênero *Bracon* Fabr. parasitas da lagarta rósea da *Platycdra gossypiella* (Hym. Braconidae)** [On two Species of *Bracon*, Parasites of *P. gossypiella*.]—*Arq. Inst. biol.* **21** pp. 135–140, 1 pl., 1 fig., 6 refs. São Paulo, 1954. (With a Summary in English.)

The author considers that the parasite of *Platycdra gossypiella* (Saund.) on cotton in Brazil that was recorded by him as *Bracon* sp. [*R.A.E.*, A 8 446] and later erroneously referred to the genus *Iphibracon* [**26** 701] is the same as the parasite of *P. gossypiella* that Muesebeck identified for Sauer as probably identical with *Bracon* (*Microbracon*) *vulgaris* Ashm. [**28** 10]. Muesebeck now considers this to represent a distinct subspecies of *B. vulgaris*, which the author here describes from adults of both sexes as *B. v. muesebecki*, subsp. n. Three females and a male of a Braconid described as *B. saueri*, sp. n., were taken in Bahia in 1951 together with an example of *B. v. muesebecki* in cotton bolls infested by *P. gossypiella*; this is believed to be the other species of *Bracon* (*Microbracon*) recorded from that host by Sauer [**28** 10].

STRINGER (A.), WOODCOCK (D.) & SKERRETT (E. J.). **Insecticidal Activity and chemical Constitution: Analogues and Isosteres of DDT.**—*Ann. appl. Biol.* **43** no. 3 pp. 366–378, 5 figs., 19 refs. London, 1955.

It has been suggested that the most toxic analogues of DDT are those that most resemble it in molecular shape and weight. If steric requirements alone are necessary for optimal toxicity, isosteres of DDT in which the chlorine atoms have been replaced by spatially similar atoms or groups should resemble DDT in their activity. Various isosteres of p,p′DDT were prepared, in which the dimensions of the hydroxyl group (radius 1·7 Å) or methyl group (2 Å) agreed reasonably well with that of the chlorine atom (1·8 Å) replaced by them and the degree of structural conformity was well within the limits required for isosteric activity in serological reactions. The electrical analogy between these isosteres and p,p′DDT was less complete, and, since it was thought that the high insecticidal activity of DDT might be associated with the presence of strong electrophilic groups in the aliphatic part of the molecule, various di-p-chlorophenyl alkanes fulfilling these conditions were also synthesised.

In the experiments reported, the toxicity to *Calandra granaria* (L.), *Dysdercus fasciatus* Sign. and *Locusta migratoria migratorioides* (R. & F.) of p,p′DDT, 12 isosteres of it and 19 other related compounds, including several nitroalkanes, was investigated. The materials were applied as crystalline deposits or oil films on filter paper on which adults of *Calandra* were exposed [*cf. R.A.E.*, A **38** 84], topically as solutions in *Arachis* oil and acetone to adult males of *Dysdercus* and *Locusta*, respectively, and, in the case of *Locusta*, by injection of aqueous suspensions into the abdomen. None of the compounds appeared to be toxic to *Locusta* by either method of application, and p,p′DDT was ineffective against it even when 1 mg. was applied topically to the abdomen; some evidence was obtained that the epidermis of this locust may prevent the entry of DDT into the body. In the tests with *Calandra* and *Dysdercus*, the successive replacement of the chlorine atoms of DDT by methyl and hydroxyl groups was accompanied by marked and increasing loss of toxicity, and the relative potencies (as

compared with 100 for p,p'DDT) of various isosteres and other compounds tested against these two insects are shown in tables and diagrams. Against *Calandra*, the relative potency of the only effective isostere (1-p-chlorophenyl-1-p-tolyl-2,2,2-trichloroethane) was only 3·2; of the other compounds, the most effective were 1,1-di-p-chlorophenyl-2-nitropropane (referred to as S.39) and 1,1-di-p-chlorophenyl-2-nitrobutane (S.138), of which the relative potencies were 180 and 78, respectively. In the tests with *Dysdercus*, p,p'methoxy-DDT was the most effective of the five toxic isosteres, with a relative potency of 187, and the relative potencies of the others did not exceed 55; S. 39 and S. 138 were the most effective of the other compounds, with relative potencies of 135 and 100, respectively. In general, *Calandra* appeared to be moderately resistant and *Dysdercus* relatively susceptible, but the tolerance variance for all the toxic compounds remained remarkably constant, and it is concluded, despite the different methods of application, that *Calandra* is less susceptible to the isosteres than *Dysdercus*, whereas the two species show the same order of susceptibility, relative to DDT, to the nitro-compounds. In view of the close relationship of the compounds, it is reasonable to assume that their activity, if any, is fundamentally due to the same mode of action.

The significance of the results are reviewed in the light of current theories regarding the structure and toxicity of DDT. Many of the compounds expected to be toxic were not so, and their inactivity can be attributed either to the invalidity of the initial hypotheses or to the operation of biological factors preventing concentration of the compound at the site of action. In all the compounds, the nature of the atoms or groups attached to the carbon atom of the aliphatic portion of the molecule was critical, though toxicity did not appear to be closely related with similarities of spatial arrangement of this atom, DDT and S. 39 being of the same order of activity, and the isosteres, though spatially similar, being generally inactive.

Taylor (L. R.). **The Standardization of Air-flow in Insect Suction Traps; with an Appendix by W. S. Coleman.**—*Ann. appl. Biol.* **43** no. 3 pp. 390–408, 2 graphs, 9 refs. London, 1955.

An account is given in the main paper of investigations on the accurate assessment of the volume of air sampled in suction traps for insects, and the following is almost entirely the author's summary of the results. The air-flow and its variations in 16 suction traps of five types that were used at Rothamsted were measured, regularity of air sample size being taken as the criterion of efficiency. Traps with the air filtering cone enclosed in a cylinder and using axial flow fans with single-phase capacitor-start-and-run or three-phase motors [*cf. R.A.E.*, A **43** 279] are the most efficient and can have normal working limits of ± 4 per cent. of the mean air delivery. However, for smaller traps that are to be used only close to the ground or in cover, the original type with exposed cone and shaded-pole motor [**38** 296; **40** 39] is quite satisfactory, provided that certain precautions are taken. Normal working limits of ± 8 per cent. are then obtained. The sources of these errors are discussed in detail and the expected errors in more extreme conditions and with other traps are indicated.

The appendix comprises an account of further observations made because the determination of air-flow through the smaller, exposed-cone traps presented difficulties that did not occur with the larger ones. It is concluded that a small correction is necessary to the flow figures given in the main paper.

Jenkinson (J. G.). **The Incidence and Control of Cauliflower Mosaic in Broccoli in South-west England.**—*Ann. appl. Biol.* **43** no. 3 pp. 409–422, 5 graphs, 7 refs. London, 1955.

The virus of cauliflower mosaic, of which *Myzus persicae* (Sulz.) and *Brevicoryne brassicae* (L.) appear to be the main vectors, causes considerable losses of broccoli in Devon and Cornwall [*cf. R.A.E.*, A **31** 228], where the chief varieties grown are harvested before the next year's crop is sown and the virus must survive the interval between crops on other plants, these being mainly spring cabbage, summer cauliflower and cruciferous seed crops. Many farms are so small that it is difficult to isolate broccoli from sources of infection and the value of protecting the seed-beds was accordingly investigated in Devon during 1950–52. The following is largely based on the author's summary of the results.

Broccoli yields can be increased by using plants raised in seed-beds situated half a mile from old infected crucifers. Surrounding the seed-beds with crops of kale or barley decreased the incidence of mosaic, even when the seed-beds were only five yards from infected plants; beans were less satisfactory, and this is attributed partly to the thinner stand of plants and to the development on them of *Aphis fabae* Scop., which is also a vector of cauliflower mosaic. Most of the plants found infected at harvest have contracted the infection after transplanting. A plant infected in the seed-bed or early in the growing season can result in a group of infected plants immediately round it in the field and almost as many farther away. Spread can occur in the same pattern from these secondarily infected plants. Loss of yield is correlated with the time at which the plants become infected. Those infected as seedlings produce little or no curd or seed, whereas those infected when nearing maturity yield almost as well as uninfected plants. The numbers of alates of *M. persicae* and *B. brassicae* taken on adhesive traps [*cf.* **38** 355] raised 4 ft. 6 ins. above the ground were positively correlated with the numbers of plants infected, and symptoms in field plants generally appeared 8–9 weeks after infection.

The severity of the symptoms differed in individual plants, and inoculation experiments with broccoli and Chinese cabbage established the existence of two strains of the virus, both of which are common in south-western England. One of them causes severe symptoms, especially in plants infected when young, and considerably reduces the size of the plant, whereas the other, which has little effect on plant size, causes faint yellowing of the veins of some or all of the leaves, this symptom often disappearing for 2–3 weeks and reappearing on younger leaves.

Storey (H. H.) & Ryland (A. K.). **Transmission of Groundnut Rosette Virus.**—*Ann. appl. Biol.* **43** no. 3 pp. 423–432, 14 refs. London, 1955.

The following is largely based on the authors' summary of this account of work on the transmission of the virus of groundnut rosette [*cf. R.A.E.*, A **24** 285; **32** 257; **43** 92], carried out in Tanganyika in 1949–51 and later in Kenya. Early investigators failed to transmit the virus by mechanical inoculation, but in the present work small percentages of test plants that had been etiolated by being kept in the dark for 48 hours were successfully infected by inoculation with the juice from diseased leaves to which Celite had been added. *Aphis craccivora* Koch, the known vector [**41** 194], transmitted the virus by feeding on halves of germinating groundnut seeds, and a convenient and flexible technique that was developed from that used in work on the swollen-shoot virus disease of cacao [*cf.* **39** 47] is described.

Different strains of *A. craccivora* appeared to vary in inherent efficiency

in transmission, and one collected on groundnuts near Amani failed ever to transmit. Within strains that could transmit, all nymphal forms and both alate and apterous adults were capable of transmission; at some times alates and at others apterae were significantly the more efficient as vectors. In a field experiment at Amani, apterae and nymphs moving over the soil appeared to play a predominant part in secondary spread round an infected plant. Comparative tests with batches of 1–4 infective Aphids supported the hypothesis that infection is by individual insects and independent of the number present. Single adults that had developed on a diseased plant and were allowed test feeds of 24 hours on healthy plants on ten successive days without access to an outside source of virus were able to infect on any day up to and including the tenth. Similarly, infective alates allowed seven successive test feeds, each of one hour, during one day transmitted the virus repeatedly, one highly infective individual infecting in six of the seven. The virus is therefore thought to be of the persistent type. Previously non-infective Aphids acquired the virus by feeding on a half-seed during the third day from its first exposure to infective Aphids.

Posnette (A. F.) & Todd (J. McA.). **Virus Diseases of Cacao in West Africa. VIII. The Search for Virus-resistant Cacao.**—*Ann. appl. Biol.* **38** no. 4 pp. 785–800, 17 refs. London, 1951. **IX. Strain Variation and Interference in Virus 1A.**—*Op. cit.* **43** no. 3 pp. 433–453, 2 graphs, 14 refs. 1955.

The following is virtually the authors' summary of the first of these two parts of a series [*cf. R.A.E.*, A **39** 46, etc.]. The methods used and the results obtained in ten years' search for cacao resistant to swollen-shoot disease in the Gold Coast are described. Selection among the trees surviving in farms devastated by this virus disease led to the discovery of mild virus strains which can protect trees against virulent strains [*cf.* **37** 86; **39** 370; **40** 363; **43** 79]. When tested by graft inoculation with virulent virus 1A, none of the selections showed any immunity or resistance save that conferred by previous mild-strain infection. A low degree of tolerance was found in some selections. Local selections and a range of new introductions were tested by exposure to infective examples of *Pseudococcus njalensis* Laing, and only types from the Upper Amazon region of Ecuador were consistently resistant to infection [*cf.* **39** 371; **40** 364, 365]. This genetical resistance seems to be strongest in cacao from the Nanay Peninsula, near Iquitos.

The following is virtually the authors' summary of the second part. Cacao virus 1A, the most important and prevalent of the swollen-shoot viruses that attack cacao in the Gold Coast, occurs in strains that differ widely in their virulence towards cacao. Outbreaks usually contain trees infected with different strains and individual trees are often infected simultaneously with more than one strain; this can be demonstrated by coppicing the trees, and by inoculating sets of test plants with grafts from different parts of one tree. Neither mild nor virulent strains seemed to be consistently dominant in roots or in other parts of cacao trees. Cacao plants infected with mild strains were nearly always protected against the effects of infection by virulent strains; however, virulent strains entered hosts already infected with mild strains, but usually without causing any symptoms unless the plants were coppiced. The severe symptoms that developed on new growth from such coppiced plants were seldom repeated in later growth. *P. njalensis* transmitted the virulent strains from leaves with symptoms characteristic of infection by the latter, but not from leaves free from such symptoms. These results suggest that the multiplication of a virulent strain is impeded in plants infected with a mild strain.

In the field, infection with a mild strain protected mature trees against the effects of virulent strains spread by mealybugs. During three years in which 273 of 387 previously infected trees became severely diseased, only 35 of 416 infected with the mild strain developed symptoms of infection with the virulent strain. Five years after infection with the mild strain, trees were yielding one pod per tree more than in the year they were infected, whereas the decrease on trees infected with the virulent strain was 16 pods per tree. Some limitations in the practical application of protection by mild strains, and objections to its use as a control measure, are discussed.

HUTCHINSON (M. T.). **An ecological Study of the Leafhopper Vectors of Blueberry-stunt.**—*J. econ. Ent.* **48** no. 1 pp. 1–8, 4 figs., 13 refs. Menasha, Wis., 1955.

MARAMOROSCH (K.). **Transmission of Blueberry-stunt Virus by** *Scaphytopius magdalensis*.—*T. c.* p. 106, 1 ref.

The virus that causes stunt disease of cultivated blueberries in New Jersey was found by earlier workers to be transmitted by mixed batches of *Scaphytopius magdalensis* (Prov.) and *S. verecundus* (Van D.) [*R.A.E.*, A **39** 172]. Investigations on the ecology of these two Cicadellids are described in the first paper. No reliable means were found for differentiating the adult females of the two, but the males can be distinguished by the genitalia and the nymphs by differences in colour and colour-pattern. In 1949–54, surveys made throughout the principal cranberry- and blueberry-growing regions of southern New Jersey and preliminary surveys in Maine, Pennsylvania and other States showed that *S. magdalensis* was abundant in blueberry fields and virtually absent from cranberry bogs, whereas the converse was true of *S. verecundus*; both were present in comparable numbers at various heights above ground in semi-open areas covered with pine trees and various ericaceous plants, but *S. verecundus* was rare in heavily shaded areas, and investigations indicated that the ecological separation is due to the fact that *S. verecundus* will not tolerate shaded areas or *S. magdalensis* extensive open areas. Both species fed and reproduced readily on both cranberry and blueberry, but only *S. verecundus* readily maintained itself on *Kalmia angustifolia* and *Chamaedaphne calyculata* which are common weeds in the pine areas. The two species appear to differ in geographical distribution, *S. magdalensis* being much better adapted to northerly conditions [*cf. loc. cit.*].

The life-cycles of the two species are similar, both completing the nymphal stage in about a month and having two generations a year. The eggs are inserted into the leaves, and those of *S. verecundus* hatch later in spring than those of *S. magdalensis*. Interbreeding did not occur in limited tests. Dryinids, probably of a single species, were found parasitising both Jassids.

Transmission of the blueberry-stunt virus resulted from the feeding of a single male of *S. magdalensis* in August 1951, but no infection was obtained in 1950, 1951 or 1953 in 40 tests with 500 nymphs and adults of *S. verecundus* that fed for two weeks or more on diseased blueberry plants and then for up to three weeks on healthy ones.

In the second paper, the author describes experiments in which six females of each species caught in the field in New Jersey were caged individually on potted blueberry seedlings. After 15 months, when, owing to dormancy and the resulting lack of food, the original females and their progeny had died, the plants were fumigated and maintained for a further 15 months. The four surviving plants of those that had been exposed to *S. verecundus* were still healthy at the end of the test period, whereas three of the five survivors that had been exposed to *S. magdalensis* showed

pronounced signs of blueberry stunt. Uninfested seedlings remained healthy. It is concluded from these observations and those recorded in the first paper that the vector of the disease in New Jersey is *S. magdalensis* and probably not *S. vercecundus*.

KULASH (W. M.) & MONROE (R. J.) **Field Tests for Control of Wireworms attacking Corn.**—*J. econ. Ent.* **48** no. 1 pp. 11–19, 2 graphs, 2 refs. Menasha, Wis., 1955.

The following is based on the authors' summary. Maize in eastern North Carolina is attacked by wireworms of several species, and tests on their control were carried out in 1950–52 in Hyde County, where *Melanotus communis* (Gylh.), *Conoderus lividus* (Deg.) and *Glyphonyx recticollis* (Say) were the most abundant and the first of these the one chiefly concerned. Observations showed that the wireworms fed on the sown seeds and prevented germination if the damage was extensive. Feeding on the seeds continued until the plants were 6–10 ins. high and then occurred on the stems.

The tests showed that seed treatment was less effective than other methods in protecting the maize. In 1950, seed treatment with heptachlor resulted in an estimated stand of 70 per cent. six weeks after sowing, as compared with 90 per cent. for soil treatment with heptachlor or for a combination of the two. Soil treatment with 5 lb. DDT per acre four months before sowing or with 37·5 lb. just before it was ineffective, an application of 7·5 lb. chlordane per acre just before sowing was ineffective unless preceded by one of 5 lb. per acre four months earlier, and the best soil treatment was 5 lb. heptachlor per acre applied just before sowing. In 1951, a combination of treating the soil and applying a mixture of fertiliser and insecticide to the drill row, both just before sowing, was the most effective method of application, and treating the seed in addition conferred no advantage. Heptachlor at 2 lb. per acre per treatment was the most effective material, followed by lindane [almost pure γ BHC] and dieldrin at the same rate, aldrin at 1 lb. and chlordane at 5 lb., in that order. In 1952, the combination of treated soil and fertiliser-insecticide mixture applied in the row at the time of sowing was again the best treatment, followed by application of the mixture only; dieldrin, heptachlor, aldrin and lindane, all used at 2 lb. per acre per treatment, gave the best results, in that order; EPN [ethyl p-nitrophenyl thionobenzenephosphonate] and demeton [diethyl 2-(ethylmercapto)ethyl thiophosphate] were not effective.

MARSHALL (W. F.) **Apple Mite Populations under six Control Programs.**—*J. econ. Ent.* **48** no. 1 pp. 23–24, 8 refs. Menasha, Wis., 1955.

Tetranychus telarius (L.) (*bimaculatus* Harvey) and *Metatetranychus ulmi* (Koch) were more difficult to control than any other pests of apple in Indiana in 1953, possibly owing to severe summer drought. Various acaricides were tested for their control on trees of three varieties that had received a previous application of sulphur and DDT against fungi and insects. Mite counts made about every four days between 25th June and 8th September showed that the three varieties required treatment at different intervals, and sprays were therefore applied as necessary to prevent excessive injury. The most dependable of the six materials tested proved to be 2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite, at 1·5 lb. per 100 U.S. gals., which kept mite populations low when applied only three times. Of the others, 1,1-bis(p-chlorophenyl)ethanol, applied 5–6 times at 1 U.S. pint, ethyl p-nitrophenyl thionobenzenephosphonate [EPN], applied

4–7 times at 0·75 lb., O,O-diisopropyl N,N-diethylthiocarbamyl dithiophosphate, applied 3–6 times at 2·5 lb., and ethyl 4,4′-dichlorobenzilate, applied 5–6 times at 1·5 lb., were less effective, and parathion applied at 2 lb. five times to one variety and ten times to another permitted the development of large numbers of mites late in the season.

SCHROEDER (H. O.). **Some Factors influencing the Effectiveness of Piperonyl Butoxide-Pyrethrins Combinations for the Control of Insects in stored Grains.**—*J. econ. Ent.* **48** no. 1 pp. 25–27, 3 refs. Menasha, Wis., 1955.

Powders containing pyrethrins with piperonyl butoxide as a synergist are used for the protection of grain from insect infestation, and experiments were carried out in Maryland to determine the influence of various factors on their effectiveness. The tests were made at a constant temperature of 80°F. and 60–70 per cent. relative humidity, in jars containing 200 gm. grain, with a moisture content of 12–13 per cent. unless otherwise stated, these conditions being favourable for insect survival and reproduction. *Calandra* (*Sitophilus*) *oryzae* (L.) was the principal test insect, and mortality counts were made after exposure for 7, 30 or 60 days. In shelled maize containing 10–15 per cent. moisture that was treated with Pyrenone Grain Protectant (0·8 per cent. technical piperonyl butoxide and 0·05 per cent. pyrethrins), over 90 per cent. mortality was given in a week by the recommended dosage of 100 lb. per 1,000 bushels at moisture contents ranging up to 13 per cent. and by a dosage of 140 lb. at 15 per cent., and 100-lb. dosage gave complete or almost complete kill in 30 days at all moisture contents. Observations after 60 days showed that reproduction by the weevil was very low for all dosages, except at moisture contents above 13 per cent., and that the 140-lb. dosage controlled reproduction even in grain containing 15 per cent. moisture.

Tests in which maize treated with 100 lb. Pyrenone Grain Protectant per 1,000 bushels and stored for 30, 60 or 90 days was exposed to infestation by *C. oryzae* showed that the powder remained highly effective for 90 days, whereas treatment of wheat with 75 lb. Pyrenone Wheat Protectant (1·1 per cent. technical piperonyl butoxide and 0·08 per cent. pyrethrins) per 1,000 bushels had a somewhat shorter duration of effectiveness. Weevils that developed from eggs deposited shortly before the grain was treated were less affected than those from eggs deposited several weeks before treatment, and tests in which adults 1–5 weeks old were exposed to a dosage of 50 lb. Pyrenone Grain Protectant per 1,000 bushels maize showed that the younger ones were less susceptible to treatment than the older ones.

When adults of *Lacmophloeus minutus* (Ol.) (*pusillus* (Schönh.)), *Oryzaephilus surinamensis* (L.), *Rhizopertha dominica* (F.) and *C. oryzae* and larvae of *Tenebroides mauritanicus* (L.) were added to wheat treated with 35 lb. Pyrenone Wheat Protectant per 1,000 bushels, they showed a wide difference in susceptibility, the percentage mortality being 97, 79, 53, 34 and 0, respectively, after seven days and 100, 89, 88, 43 and 40 after 30 days.

PAINTER (R. H.). **Insects on Corn and Teosinte in Guatemala.**—*J. econ. Ent.* **48** no. 1 pp. 36–42, 19 refs. Menasha, Wis., 1955.

Among some 180 insects collected in Guatemala in late summer in 1951 and 1952 on maize or teosinte (*Euchlaena mexicana*), which is native to the region and the wild plant most nearly related to maize, only 93 could be identified to species, 66 from maize, 12 from teosinte and 15 from both. A systematic list of these is given, with notes on the circumstances in which

they were obtained and in some cases on their bionomics and importance. The insects that were most destructive to the growing maize were species of *Diabrotica* and related genera, *Diatraea lineolata* (Wlk.) and *D. saccharalis* (F.), *Euxesta major* Wulp, and *Laphygma frugiperda* (S. & A.), which was by far the most conspicuous pest of all.

D. saccharalis was more abundant than *D. lineolata* in most areas. The eggs of both species were laid in masses, and the larvae skeletonised the leaves in the whorl, tunnelled in the stems and attacked the pith, but rarely the kernels, in the ears, leading to rotting. Oviposition also occurred on teosinte. Eggs collected on maize at one place were heavily parasitised, possibly by *Trichogramma minutum* Ril., cocoons of *Apanteles diatraeae* Mues. were common in the larval burrows, and an unidentified Muscoid fly was apparently parasitic on the larvae. *A. diatraeae* was itself parasitised by *Horismenus floridanus* (Ashm.), and the puparia of the Muscoid by *Trichopria* sp. *Paratheresia claripalpis* (Wulp), which is known to parasitise species of *Diatraea*, was present in several areas. The predators observed included the Carabid, *Leptotrachelus testaccus puncticollis* Bates, and probably the pseudoscorpion, *Lustrochernes reimoseri* Beier, and the earwig, *Doru lineare* (Esch.), both of which were observed breeding in *Diatraea* burrows.

Young larvae of *Laphygma frugiperda* fed in the whorl and on the developing tassel, and older ones burrowed in the stem and ear shoots and fed on the kernels in the developing ears. The females are known to lay up to 5,000 eggs each in groups of 40 or more on the upper part of the stem, and the larvae pupate in the soil or under débris. The Tachinid, *Achaetoneura archippivora* (Will.), was reared from the larvae in considerable numbers, and the Carabid, *Onypterygia faminii* Solier, was observed attacking them. The corn earworm, *Heliothis zea* (Boddie) (*armigera*, auct., *umbrosa* Grote [*cf. R.A.E.*, A **42** 421]) was in general not numerous on maize.

Larvae of *E. major* were observed in the bases and tips of the ears as well as in the buds, and also attacked teosinte. *Franklinicella williamsi* Hood, which caused severe damage to seedlings of maize and teosinte, was controlled by sprays of 4 lb. DDT or 4 oz. aldrin or dieldrin per 100 U.S. gals.

Braid (P. E.) & Dustan (G. G.). **Parathion Residuals on immature Peaches and the Hazard in spraying and thinning Operations.**—*J. econ. Ent.* **48** no. 1 pp. 44–46, 2 graphs, 7 refs. Menasha, Wis., 1955.

The following is based on the authors' introduction and summary. Since exposure to parathion residues while sprayed peach fruits are being thinned by hand has been alleged to cause ill effects in the Niagara district of Ontario, observations were made on the loss of residues over a 31-day period beginning in July. These showed that sprays containing 1 and 2 lb. 15 per cent. wettable parathion per 100 gals. water resulted in initial residues of 30 and 70 mmg. per 100 sq.cm., respectively, on immature peaches. The initial rates of decay of the residue were 2·2 and 4·2 mmg. per 100 sq.cm. per day, and these were maintained for approximately 12–14 days, after which there was little further loss. It is concluded that the recommended period of seven days between spraying and thinning if protective clothing is worn, or of 14 days if it is not, should be retained.

Ubertalli (J. A.). **Life History of** *Eotetranychus uncatus* **Garman.**—*J. econ. Ent.* **48** no. 1 pp. 47–49, 1 fig., 2 refs. Menasha, Wis., 1955.

Eotetranychus uncatus Garman [*R.A.E.*, A **41** 374], all stages of which are described, has recently become an important pest of deciduous fruit

trees in Massachusetts and Connecticut and causes severe damage to apple foliage when abundant, sometimes resulting in total leaf drop. Laboratory and field observations in 1953 showed that the winter was passed by adult females that fed as long as foliage was present and then overwintered on the tree under loose scales of bark. In Massachusetts, they were produced in early October. The adults became active again at the late or delayed-dormant stage of bud development on McIntosh apples and moved to the spur leaves, on which they fed for several days before ovipositing. Unfertilised and fertilised females deposited eggs that gave rise to males and females, respectively. The preoviposition and incubation periods ranged from two days at an average temperature of about 82°F. to six days at 72·7° and nine days at 69·8°, respectively, and the larval, protonymphal and deutonymphal stages, each of which terminates with a resting period, lasted 2–6, 2–6 and 1–3 days for males and 1–6, 2 and 2–10 days for females at similar temperatures. The minimum time for development from hatching to the adult stage was 5 days at 80·5°F., and the maximum was 12 days for males at 73·4° and 20 for females at 70·8°F.; the maximum length of adult life was eight days for males at an average temperature of 66·7° and 14 days for females at 70·1°F.

Summerland (S. A.) & Hamilton (D. W.). **Biology of the Red-banded Leaf Roller in southern Indiana.**—*J. econ. Ent.* **48** no. 1 pp. 51–53, 1 fig., 1 ref. Menasha, Wis., 1955.

Eulia (*Argyrotaenia*) *velutinana* (Wlk.), which attacks deciduous fruit trees and other plants over much of the United States, has become a serious pest of apple in the eastern area and the Midwest since the introduction of DDT [*cf. R.A.E.*, A **37** 381; **38** 57, 106]. It has been important on this crop in southern Indiana since 1946, and investigations there in 1950–53 showed that it overwinters as a pupa in débris on the ground under the tree on which it fed as a larva, adult emergence generally beginning towards the end of March. The females are fertilised and oviposit within three days of emerging, usually depositing egg-masses on the larger smooth-barked branches. Hatching of the first generation lasts only a few days and is practically complete by petal-fall, and the larvae feed on the leaves, to which some are carried by wind. There are three complete generations and a partial fourth in the year. The eggs of the later generations are usually laid on the leaves, and larvae that develop late in the season feed almost entirely on the fruits, causing severe damage just before harvest. The larvae withstand very low temperatures, even surviving freezing for five days, and sometimes continue to feed on apples in cold storage. They are parasitised by *Itoplectis conquisitor* (Say) and *Pimpla* (*Coccygomimus*) *aequalis* Prov. and attacked by a granulosis virus disease [*cf.* **41** 210], which has caused substantial reductions in the population in orchards throughout southern Indiana in recent years.

van den Bosch (R.), Bartlett (B. R.) & Flanders (S. E.). **A Search for natural Enemies of Lecaniine Scale Insects in northern Africa for Introduction into California.**—*J. econ. Ent.* **48** no. 1 pp. 53–55, 2 refs. Menasha, Wis., 1955.

Introduced natural enemies have largely controlled *Saissetia oleae* (Bern.) on *Citrus* in the mild coastal regions of southern California, but have been less effective in the interior, where the scale has only one generation a year and the climate is more severe [*cf. R.A.E.*, A **42** 264].

Of the other Lecaniines present on various orchard and ornamental trees and shrubs, *Coccus pseudomagnoliarum* (Kuw.), *C. hesperidum* L. and *Eulecanium* (*Lecanium*) *corni* (Bch.) are the most important and *E.* (*L.*) *pruinosum* (Coq.), *E.* (*L.*) *kunoense* (Kuw.) and *S. coffeae* (Wlk.) (*hemisphaerica* (Targ.)) are of occasional local significance. Attempts were made in January–May 1953 to find additional natural enemies of *S. oleae* and the other scales in Morocco, Kenya and the Hamasien plateau of Eritrea, where the climate is similar to that of the interior of California, and as a result, 15 species were imported and studied. These included the solitary internal parasites, *Coccophagus cleaphilus* Silv. from Eritrea and Morocco, and *C. eritreaensis* Comp. and an undescribed species of *Metaphycus* referred to as Y, from Eritrea, the gregarious internal parasite, *Diversinervus elegans* Silv. from Eritrea, and the internal parasite, *M. flavus* (How.), which can be either solitary or gregarious, from Morocco; all these were liberated in the field in southern California, and the first and third were recovered from *S. oleae*, the second from *Coccus hesperidum*, the fourth from *S. oleae*, *C. hesperidum* and *C. pseudomagnoliarum*, and the last from *S. oleae* and *C. pseudomagnoliarum*. Parasites that were released but have not been recovered comprised *Coccophagus nigritus* Comp., *C. baldassarii* Comp. and *M. praevidens* (Silv.), all from Eritrea; *Euxanthellus* sp. and *Metaphycus* sp. from Eritrea and *M. hemilecanii* Comp. from Kenya were not liberated.

Coccinellid predators, comprising a species of *Chilocorus* near *C. distigma* (Klug), an undescribed species of *Hyperaspis* and a species of an undescribed genus near *Platynaspis* from Eritrea and *Exochomus quadripustulatus floralis* (Motsch.) from Morocco, fed on various scale insects and mealybugs in the laboratory and were released in limited numbers, but have not been recovered. The conditions under which the parasites and predators were collected and certain aspects of their bionomics in the laboratory are described.

Anthon (E. W.). **Evidence for Green Peach Aphid Resistance to organophosphorous Insecticides.**—*J. econ. Ent.* **48** no. 1 pp. 56–57, 3 refs. Menasha, Wis., 1955.

Malathion, parathion and TEPP [tetraethyl pyrophosphate] formerly gave effective control of *Myzus persicae* (Sulz.) on peach in north-central Washington, but the first two and mixtures of parathion and DDT proved unsatisfactory in several orchards in April 1953, and tests were therefore made in April and May to ascertain whether the Aphid had developed resistance to these insecticides.

Applications of 1·5 pints 57 per cent. malathion and 0·5 pint Systox (containing 42·4 per cent. demeton [diethyl 2-(ethylmercapto)ethyl thiophosphate]) per 100 gals. water on 24th April caused 75·8 and 99·3 per cent. mortality, respectively, as compared with none on the controls, 0·25 pint Systox, 0·5 pint 25 per cent. parathion emulsion concentrate, 33 per cent. Metacide [methyl-parathion and parathion] or 20 per cent. TEPP, 1 pint 40 per cent. nicotine and 1·5 pints 57 per cent. malathion emulsion concentrate per 100 gals., applied on 5th May, caused 97·9, 15·5, 33, 98·6, 98 and 33·4 per cent. reduction in population, and 0·5 lb. 25 per cent. wettable parathion and 1 lb. 25 per cent. lindane [almost pure γ BHC] per 100 U.S. gals. applied on the same date and 2 lb. 25 per cent. parathion applied later caused 5·3 per cent. increase and 74·6 and 12 per cent. decrease in population, respectively. Subsequent treatment with TEPP by growers gave fair control in one instance and none in two others, and applications of malathion and parathion throughout May had very little effect. When Aphids from trees that had been sprayed several times with phosphorus

insecticides were brought into the laboratory, sprays of 1 lb. 25 per cent. wettable parathion per 100 U.S. gals. gave excellent control.

Difficulty was experienced in controlling *M. persicae* on potato in the lower Yakima Valley in 1952. Examples that were collected from a field in which sprays of DDT, TEPP, parathion and malathion, mostly applied from aircraft, had proved unsatisfactory and that were brought to the laboratory were all well controlled by sprays of parathion, malathion, Systox and lindane. The reason for the differing susceptibility to the phosphorus compounds in the field and laboratory is not known, but it is concluded that, with the exception of Systox, they are becoming less effective in the field.

Lange jr. (W. H.) & Carlson (E. C.). **Zonal Dispersion of Chemicals in Soil following several Tillage Methods.**—*J. econ. Ent.* **48** no. 1 pp. 61–67, 6 figs., 3 refs. Menasha, Wis., 1955.

Various methods of incorporating into the soil insecticides that have been applied to its surface for the control of subterranean insects were compared in California in 1951. Lindane [almost pure γ BHC], aldrin, dieldrin and DDT at 2, 10, 5 and 20 lb. per acre, respectively, were applied in wettable-powder sprays in April to a clay loam soil, which was then harrowed each way with a spike-tooth to a depth of 1·75–2·25 ins., rotary tilled once to a depth of 4·75–5 ins. or disked six times in two directions to a depth of 4·5–5·5 ins. The distribution of the chemicals in the soil was determined by subjecting soil samples taken at depths of 0–2·5 ins. and 2·5–5 ins., seven and 148 days after treatment, to bioassay with the wireworm, *Limonius canus* Lec., and, for dieldrin and aldrin, to bioassay with the house-fly [*Musca domestica* L.] and colorimetric determination, respectively.

Harrowing was found to give the most unequal distribution, with 6–150 times as much insecticide in the upper as in the lower 2·5 ins.; this resulted in rapid wireworm kill in the upper soil, but poor kill in the lower. Rotary tillage and disking gave more equal mixing, though 41 per cent. more aldrin and 74 per cent. more dieldrin were found in the upper than in the lower 2·5 ins. There was little consistent difference between these two methods of incorporation. There were average losses of 44 and 14 per cent. aldrin and dieldrin, respectively, from the upper 2·5 ins. of soil in 148 days, as determined by the colorimetric method and bioassay with *M. domestica*. Lindane at 2 lb. per acre and aldrin at 10 lb. gave the highest mortalities of *L. canus* at both levels in the soil and at both examination dates. Lindane was found to contaminate soil 10–12 ins. beyond the plot boundaries, but not 3–10 ft. beyond them [*cf. R.A.E.*, A **41** 202].

Munger (F.). **Rearing Citrus Red Mites in the Laboratory.**—*J. econ. Ent.* **48** no. 1 pp. 72–74, 5 refs. Menasha, Wis., 1955.

An account is given of a method by which *Metatetranychus citri* (McG.) was successfully reared for observations on its bionomics. Green lemon fruits were arranged on a tray with their stems in damp sand, in such a way that the mites could move from one lemon to another but could not leave the tray. Predacious mites of the genus *Typhlodromus*, which were frequently introduced from the field with the fruits and destroyed the cultures, were controlled by painting the base of each stem and the area under the sepals with a paste of 50 per cent. wettable DDT and then dipping both the stem and flower ends in melted paraffin. When crowding and accumulations of webbing and excreta were observed, the infested lemons were placed on the top of fresh ones and removed when the mites

had left them. By this means, the mite was reared continuously in a screened insectary for more than two years, developing slowly in cold weather and rapidly when conditions were more favourable.

Rearing in the laboratory was less easy. At 90°F. and 16–20 per cent. relative humidity, the mites oviposited but died in two weeks, and none of the eggs hatched. At 90°F. and 61–68 per cent. relative humidity, considerable numbers of eggs were laid and many hatched, but mortality in the larval and other stages was high, and all the mites were dead after about seven weeks. At fluctuating temperatures and humidities of 64–86°F. and 50–90 per cent., the mites were successfully reared for about four months and five transfers were made, but all then died; populations were generally low. Rearing at 77°F. and 60–80 per cent. relative humidity was also unsatisfactory, populations remaining low and dying out in eight weeks, but when supplementary moisture was supplied by spraying the lemons with distilled water at intervals throughout the day, the cultures survived for 19 weeks or more, though populations were still low. The introduction of abundant fresh air into the circulation system resulted in a further improvement, and the mite was then reared at 77°F. and 60–70 per cent. relative humidity for seven months.

Tamashiro (M.) & Sherman (M.). **Direct and latent Toxicity of Insecticides to Oriental Fruit Fly Larvae and their internal Parasites.**—*J. econ. Ent.* **48** no. 1 pp. 75–79, 17 refs. Menasha, Wis., 1955.

The following is largely based on the authors' summary of this account of investigations in Hawaii on the comparative toxicity of insecticides to third-instar larvae of *Dacus dorsalis* Hend. and to larvae of the parasite, *Opius oophilus* Fullaway [*cf. R.A.E.*, A **40** 83], developing within them. The insecticides were applied topically in acetone to the healthy or parasitised fruit-fly larvae or to the sand in which they were put to pupate. Comparison of the median lethal dosages in the topical treatments showed that the parasites were less susceptible than the fruit-fly larvae to parathion, about as susceptible to isodrin, and more susceptible to aldrin, endrin, chlordane and γ BHC; both parasites and fruit-fly larvae were highly resistant to DDT. The action of the insecticides produced definite patterns of toxicity in the insects. Aldrin, isodrin, dieldrin, endrin, chlordane and γ BHC killed both parasites and fruit-flies as larvae, pupae or fully developed adults within the puparia or killed the emerging fruit-fly adults, depending on the dosage level used; no abnormally developed adult parasites emerged from the treated parasitised larvae. Most of the fruit-fly larvae treated with parathion died soon after forming the puparium, and in many instances parasitised larvae formed abnormal elongated puparia as if they had died or become paralysed before they had fully contracted. When this happened, an adult parasite occasionally developed and emerged.

The term latent toxicity is proposed for the condition in which an insecticide applied to the larvae does not fully manifest its toxic effect until the adults have emerged, and this was exhibited to a very high degree by endrin, to a high degree by aldrin, isodrin, dieldrin and chlordane and slightly by γ BHC, but did not occur with parathion. Symptoms of latent toxicity were shown much less frequently by the parasites than by the fruit-flies.

In the sand treatments, the parasites and fruit-flies were equally susceptible to both parathion and isodrin, but the parasites were the more susceptible to aldrin, dieldrin, endrin, chlordane and γ BHC. Both were highly resistant to DDT. The general pattern of toxicity resembled that produced by the topical treatments.

Fang (S. C.) & Allen (D.). **Distribution and Incorporation of radioactive Phosphorus in the Douglas-fir Beetle.**—*J. econ. Ent.* **48** no. 1 pp. 79–82, 2 graphs, 11 refs. Menasha, Wis., 1955.

Dendroctonus pseudotsugae Hopk. caused serious injury to Douglas fir [*Pseudotsuga taxifolia*] in Oregon and Washington in 1949–52, and since little is known of the physiological processes of this bark-beetle, adults were allowed to feed on 2·5 per cent. glucose solution containing 2·5 μc. per ml. ^{32}P in the form of phosphoric acid, for two days and were then investigated for radioactivity. Only 2 per cent. of the total radioactivity was removed by washing, indicating that nearly all the ^{32}P was in the insect. Dissection of the beetles showed that about 16·6, 14 and 53 per cent. of the remainder was in the head, thorax and abdomen and 6·8 and 9·3 per cent. in the legs and wings, respectively. When the beetles were ground and subjected to extraction with ether, only 3·5 per cent. of the total ^{32}P was removed; a very small amount was found incorporated in the phospholipids; 47 per cent. was extracted by 80 per cent. ethanol, 34·7 per cent. by hot water and 15 per cent. remained in the residue. In the alcohol extract, about 93 per cent. of the ^{32}P was in phosphorylated intermediates, and in the water extract more than half was in the inorganic form. It is considered that a glycolytic cycle must be present in the beetle, since most of the phosphate esters that are known to be intermediates of glycolysis were found.

Cole (C. E.) & Fisk (F. W.). **Comparative Toxicity of certain Acaricides to the carmine and green Forms of the Two-spotted Spider Mite.**—*J. econ. Ent.* **48** no. 1 pp. 85–87, 3 figs., 5 refs. Menasha, Wis., 1955.

The following is based on the authors' introduction and summary. *Tetranychus telarius* (L.) (*bimaculatus* Harvey) occurs in the United States in a carmine and a green colour form. The carmine form predominates in the south, but the green form is widespread in the north, where the carmine form is restricted to greenhouses or comparable situations [*cf. R.A.E.*, A **44** 20]. Since both forms are used in the evaluation of chemical compounds as acaricides, their relative susceptibilities to five compounds were compared by dipping or spraying kidney-bean leaves infested with mites that had developed on bean. No significant difference between median lethal dosages for the two forms was found in spray or dipping tests with Aramite [2-chloroethyl 2(p-tert.-butylphenoxy)-1- methylethyl sulphite] or DMC [1,1-bis(p-chlorophenyl)ethanol] or in dipping tests with TEPP [tetraethyl pyrophosphate]. In dipping tests, the green form was significantly the more susceptible to EPN [ethyl p-nitrophenyl thionobenzenephosphonate] and the less susceptible to malathion. In further tests, a population of the red form from squash, tested on bean, was less susceptible to DMC than the red form from bean, but the two were equally susceptible to malathion.

On the basis of these and earlier investigations [**39** 169], it is concluded that the relative susceptibility of the colour forms of *T. telarius* varies with the acaricide, and that the differences may be affected by the food-plant. They cannot be predicted and should not be overlooked in quantitative evaluation work.

Van Middelem (C. H.) & Wilson (J. W.). **Parathion Residues on Celery.**—*J. econ. Ent.* **48** no. 1 pp. 88–90, 13 refs. Menasha, Wis., 1955.

The following is based on the authors' introduction and summary. Tests were carried out in Florida in 1953–54 to determine the residues remaining

on unwashed mature celery after heavy and frequent applications of parathion sprays for insect control. The plants were sprayed weekly for 2, 3 or 4 months with 1·5 lb. 15 per cent. wettable parathion or 0·5 U.S. pint 50 per cent. emulsion concentrate per 100 U.S. gals. per acre, and the residues on the plants were analysed chemically at harvest. In 1953, parathion residues on the foliage averaged 0·87 and 0·61 parts per million 7 and 14 days after the eighth application, 1·05 and 1·22 p.p.m. 7 and 14 days after the twelfth application and 2·33 p.p.m. four hours after the sixteenth, for the wettable powder, and slightly less for the concentrate. Their small size may have been partly due to the high mean temperatures and abnormally heavy rainfall towards the end of the spraying season and at harvest. In 1954, when only the wettable powder was used, the foliage residues were 5·93, 5·37 and 5·25 p.p.m. four hours after the fifteenth, twelfth and ninth applications, respectively, and 1·05, 0·96 and 0·87 p.p.m. seven days after them. In this year, the rainfall was slightly below average in March and the mean temperature during the last two weeks of the spraying season was 10°F. below the mean for the same period of 1953. Stalk residues did not greatly exceed 1 p.p.m. in any test, and were usually much less. Although the residues were higher in 1954, there appeared to be little evidence of accumulation even after 15 consecutive weekly applications, and it is concluded that unwashed sprayed celery sent to market will bear residues below 2 p.p.m. if a period of seven days is allowed for weathering.

Arbuthnot (K. D.). **European Corn Borer Parasite Complex near East Hartford, Connecticut.**—*J. econ. Ent.* **48** no. 1 pp. 91–93, 2 figs., 1 ref. Menasha, Wis., 1955.

Larvae of *Pyrausta nubilalis* (Hb.) were collected from maize throughout 1939–51 over an area of about 78 sq. miles near East Hartford, Connecticut, according to a system that is described, to investigate the effectiveness of parasites introduced for their control [*cf. R.A.E.*, A **39** 105]. In this area, the Ichneumonid, *Angitia* (*Horogenes*) *punctoria* Roman, and the Tachinid, *Lydella stabulans grisescens* R.-D., became established before 1939, and the Braconids, *Chelonus annulipes* Wesm. and *Macrocentrus gifuensis* Ashm., in 1939 and 1941, respectively, and these four were present together throughout the rest of the period. No other introduced species became established, and no native species parasitised as many as 1 per cent. of the larvae. *A. punctoria* was the most abundant of the parasites until *M. gifuensis* became dispersed throughout the area, in 1946–47, after which the latter was the more numerous at most of the sampling points. *A. punctoria* parasitised averages of 22 per cent. of the first-generation (summer) larvae and 8 per cent. of the second-generation (autumn) ones. Summer parasitism dropped from 36 per cent. in 1939–42 to 9 per cent. in 1948–51, and autumn parasitism from 11 per cent. in 1939–44 to 5 per cent. in 1945–51. *M. gifuensis* parasitised an average of 7 per cent. of the larvae in summer and autumn over the whole period and 13 per cent. in the last six years. *Lydella* parasitised averages of 4 and 2 per cent. in summer and autumn, respectively, the maximum observed being 10 per cent. in the summer of 1951. This species was more widely distributed and more effective in 1949–51 than in earlier years, but was not generally present in the eastern part of the area. *Chelonus* occurred rarely in the western half and was most abundant where *Lydella* was rarest; it attacked an average of 1 per cent. of the larvae of each generation throughout the period, but was found in 8 per cent. of the autumn generation in 1949.

McGarr (R. L.). **Weekly Applications of Insecticides for Control of the Pink Bollworm and the Boll Weevil.**—*J. econ. Ent.* **48** no. 1 pp. 95–96. Menasha, Wis., 1955.

In further large-scale tests of insecticides against *Platyedra* (*Pectinophora*) *gossypiella* (Saund.) and *Anthonomus grandis* Boh. on cotton [*cf.* *R.A.E.*, A **42** 306], four series of treatments were applied in the Lower Rio Grande Valley of Texas in 1953. In the first three, sprays were applied at about 5 U.S. gals. per acre at approximately weekly intervals from the first week of flowering, the quantity of insecticide applied being increased as the plants grew. In the first series, an average of 6·7 applications per plot of 1–1·5 lb. DDT per acre with either 0·25–0·375 lb. methyl-parathion or 0·25–0·33 lb. endrin, the latter schedule including 0·1 lb. demeton [diethyl 2-(ethylmercapto)ethyl thiophosphate] in the first three applications, gave substantial and approximately equal reductions of *Platyedra* populations and increased the yield from 1,217 to 1,442 and 1,458 lb. per acre, respectively; *Anthonomus* was of no importance in most of the tests. DDT with endrin appeared promising against all the principal cotton pests but spider mites, and DDT with methyl-parathion against all but high populations of *Anthonomus* after migration had begun. In the second series, an average of six applications of 1–1·5 lb. DDT per acre with 0·2–0·25 lb. each of endrin and methyl-parathion gave good control of *Anthonomus*, whereas 1–1·5 lb. DDT with 0·3–0·45 lb. γ BHC did not; both controlled *Platyedra*, and they increased the yield from 1,152 to 1,445 and 1,322 lb. per acre, respectively. In the third, an average of six applications of 1–1·5 lb. DDT with either 0·25 lb. endrin or 0·5 lb. heptachlor, or of 0·25 lb. endrin with the addition of 1·5 lb. DDT after the third application, reduced populations of *Platyedra*, the reduction being least in the last instance; infestation by *Anthonomus* was light, and the yield was increased from 938 to 1,072, 1,013 and 1,153 lb. per acre, respectively. In the fourth series, in which an average of seven applications was made at weekly intervals, beginning when neighbouring fields were about mature, 1–2 lb. DDT per acre with 0·25–0·33 lb. endrin or with 0·5 lb. chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl thiophosphate] in the first three and 0·25 lb. each of endrin and methyl-parathion thereafter gave appreciable reductions of *Platyedra* populations and fair to good control of *Anthonomus*, and increased the yield from 170 to 620 and 480 lb. per acre.

A further large-scale test was carried out in northern Mexico. Eight applications were made at weekly intervals, and 0·27–4 lb. endrin and a mixture of 0·25–0·47 lb. dieldrin, 0·5–0·75 lb. DDT and 0·125–0·25 lb. parathion per acre gave very good control of severe infestations of *Anthonomus*, satisfactory control of *Platyedra* and yield increases of 1,071 and 1,021 lb. per acre, respectively, over the yield of 545 lb. for no treatment.

Wallis (R. L.) & Douglass (J. R.). **Winter Mortality of the Mexican Bean Beetle in New Mexico.**—*J. econ. Ent.* **48** no. 1 pp. 96–101, 3 figs., 4 refs. Menasha, Wis., 1955.

The following is substantially the authors' summary. The winter mortality of the adults of *Epilachna varivestis* Muls. in the Estancia Valley of New Mexico was studied in relation to weather in six seasons from 1929–30 to 1934–35. The beetles were placed in hibernation cages in the forest zone and provided with a cover of oak leaves and pine needles.

Snow coverage was found to contribute to successful hibernation, the temperature of hibernation material under snow being as much as 21°F.

higher than that without snow cover. However, in a prolonged period of air temperatures below 0°F., such as occurred in 1932–33, the temperature of the material under snow dropped materially and mortality was high. Mortality was generally lowest towards the end of the season, just before emergence.

In seasons when the average temperatures were high and there was little moisture and snow cover, a northern slope was slightly more favourable than a southern one, probably owing to higher moisture content of the hibernation material, but in seasons of prolonged sub-zero temperatures, such as 1932–33, mortality was lower on the southern slope, which was warmed by the sun on clear days. Under optimum conditions, the northern slope was the more favourable to successful hibernation, as there was less fluctuation of moisture and temperature.

Laboratory observations showed that excessively wet or dry material was detrimental to successful hibernation; beetles exposed in wet leaves contained some 8 per cent. more moisture than those in dry ones. Exposure for two days to 10 and 21°F., respectively, resulted in 100 and 90 per cent. mortality in wet leaves and 91 and 28 per cent. in dry ones. Beetles kept for two days in moist leaves at 30°F. suffered only 3 per cent. mortality.

Stafford (E. M.) & Kido (H.). **Control of the Grape Mealybug in California.**—*J. econ. Ent.* **48** no. 1 pp. 101–102, 3 refs. Menasha, Wis., 1955.

Pseudococcus maritimus (Ehrh.) has recently caused increasing injury to table grapes in the United States, and in California, where sprays that impair the bloom on the berries are undesirable, it must be controlled by sprays applied in the dormant season or in spring or by dusts.

In 1954, dormant sprays were applied to the rough bark as thoroughly as possible at low pressure, but coverage was poor. Counts made on 15th September showed that infestation was light and variable, the mealybugs being most easily found on bunches touching the rough bark, but there were 94–100 per cent. uninfested bunches on vines sprayed with 0·005–0·01 per cent. parathion, and 80 per cent. uninfested bunches on those sprayed with 2 U.S. quarts DN-289 (dinoseb (triethanolamine)) or 4 lb. 25 per cent. wettable malathion per 100 U.S. gals.; sodium arsenite was less effective. In another test, parathion, in the form of various emulsion concentrates, applied at 0·006–0·01 lb. active ingredient in 0·7–1·6 U.S. gals. spray per vine on 8th or 9th February, increased the percentage of uninfested bunches on 14th September from 6·6 for no treatment to 52·3–92. When about the same quantity of parathion was applied per plant, the percentage varied with the amount of spray applied, and when an emulsified solution of parathion in xylene was applied at various concentrations and rates, it varied with the amount of actual parathion. The addition of dormant-oil emulsion increased the effectiveness of this formulation, and the addition of sugar that of one referred to as flowable emulsion. Sulfotepp [tetraethyl dithiopyrophosphate] at 0·008 lb. in 1·6 U.S. gals. per vine gave 64·6 per cent. uninfested bunches, but chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl thiophosphate], Holcomb 326 [O,O-diisopropyl N,N-diethylthiocarbamyl dithiophosphate] and methyl-parathion were ineffective. Similar results were obtained on another variety of grape, 0·011 lb. parathion in 0·7 U.S. gal. and 0·006 lb. parathion in 1·2 U.S. gals. xylene-emulsion spray per vine both giving over 95 per cent. uninfested bunches; the addition of sodium arsenite slightly improved the control given by parathion, indicating that the control of the mealybug and that of the condition known as black measles

of grapes is possible with one dormant spray application. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl thiophosphate] gave moderate control.

Commercial control of *P. maritimus* in summer was given by 35 lb. 2 per cent. parathion dust per acre applied in mid-June when the eggs were hatching, but not by the same dust in May, and in a vineyard in which hatching began in late June, by a parathion spray applied in early July, indicating that proper timing is necessary for good summer control with parathion; if this material is used in summer, cultural practices should be modified so that workers are not exposed to it while handling the vines.

MADSEN (H. F.) & BORDEN (A. D.). **Pre-bloom Treatments to control European Red Mite Eggs on Pears in northern California.**—*J. econ. Ent.* **48** no. 1 pp. 103–105, 3 refs. Menasha, Wis., 1955.

Metatetranychus ulmi (Koch) is one of the most important pests of pear in northern California, where the overwintered eggs hatch soon after petal-fall in April and populations increase considerably early in the season, if the weather is warm in April and early May. The foliage is rather susceptible to attack, and a population of 4–5 mites per leaf can cause serious injury. As the mite appears to have developed resistance to organic phosphates in several pear-growing districts of California, and other acaricides tend to cause foliage or fruit damage when used at petal-fall or soon after, sprays thought likely to kill the eggs were applied at the post-harvest stage (9th October 1952) and dormant, delayed-dormant and cluster-bud stages (16th January, 12th February and 20th March 1953), all spray quantities given being per 100 U.S. gals. Post-harvest sprays of 1·5 U.S. pints 50 per cent. Compound 923 [2,4-dichlorophenyl benzenesulphonate] and of 4 oz. DN-289 [dinoseb (triethanolamine)] with 1 lb. 50 per cent. Ovotran [p-chlorophenyl p-chlorobenzenesulphonate] controlled the mite until early and late June 1953, respectively, and dormant and delayed-dormant sprays of 5 U.S. gals. dormant-oil emulsion and 2 U.S. quarts DN-289, respectively, until late June. In cluster-bud applications, all of which included 2 U.S. gals. lime-sulphur and 4 lb. wettable sulphur for fungicidal control, 1·5 U.S. pints 50 per cent. Compound 923 gave good control until late July, but 3 lb. 50 per cent Sulphenone [p-chlorophenyl phenyl sulphone] and 0·5 lb. 50 per cent. Ovotran were ineffective.

In 1954, applications of dormant oil at 5 U.S. gals. alone and at 2·5 U.S. gals. with 2 lb. 25 per cent. parathion on 5th January controlled the mites until mid-June, whereas the same oil with 4 lb. 25 per cent. malathion was ineffective. In delayed-dormant applications on 22nd February, 1·5 lb. 50 per cent. Compound 923 and 2 lb. 20 per cent. Mitox (p-chlorobenzyl p-chlorophenyl sulphide) both kept mite populations low until early July, but 1 lb. 50 per cent. Ovotran, 1·5 lb. 25 per cent. Karathane [dinitrocaprylphenylcrotonate] or Chlorobenzilate [ethyl 4,4′-dichlorobenzilate] and 1·5 U.S. pints 25 per cent. DMC [1,1-bis(p-chlorophenyl)ethanol] were ineffective. Cluster-bud sprays were applied on 27th March and included lime-sulphur and wettable sulphur, except in the case of Karathane. At the same rates as before, Compound 923 and Mitox again controlled the mites until early July, and Karathane, Chlorobenzilate and DMC, though reducing mite populations slightly, did not give commercial control.

It is concluded that acaricides for use in a pre-bloom spray are best included with the lime-sulphur and wettable sulphur used against fungi at the cluster-bud stage.

Johnson (G. V.) & Feder (W. A.). **Persistence and Fumigation Effect of a Residue of Parathion and Demeton.**—*J. econ. Ent.* **48** no. 1 p. 108. Menasha, Wis., 1955.

Tests of the persistence and fumigant effect of a residue of parathion and demeton [diethyl 2-(ethylmercapto)ethyl thiophosphate] were made in New York in 1953 in a fumigation chamber with a capacity of 55 cu. ft., fitted with a galvanised iron lining, soldered joints, air circulating equipment and a door that was left open whenever fumigation was not in progress; 10 per cent. aerosols of parathion were released in it at 1, 2 and 1 oz. per 1,000 cu. ft. on 16th, 23rd and 24th March and of demeton at 1 and 2 oz. on 27th and 30th March, the period of exposure being at least 24 hours in each case, and the chamber was scrubbed with water and a detergent on 1st April, cleaned with steam on 2nd April and dismantled, scrubbed with hot water and detergent and rinsed on 3rd April. When bulbs infested by the tulip Aphid, *Anuraphis tulipae* (Boy.), were exposed for 16–21 hours at 70–80°F. in the chamber 14–38 days after the last aerosol treatment, mortality reached 47–85 per cent. in four days, and when they were exposed for similar periods 63–106 days after it, mortality was 17–25 per cent., the later figures being corrected for a high natural mortality. Some insecticidal effect still persisted after a year, Aphids confined in the chamber overnight showing uncoordinated movements and a tendency to leave the bulbs.

Gerhardt (P. D.) & Lindgren (D. L.). **Penetration of additional packaging Films by common stored-product Insects.**—*J. econ. Ent.* **48** no. 1 pp. 108–109, 1 ref. Menasha, Wis., 1955.

In further tests in California of the effectiveness of packaging films in protecting stored products from attack by insects [*cf. R.A.E.*, A **43** 45], a transparent film called Mylar, 0·001 inch thick, alone and as the outer layer of laminated films of which the inner layer consisted of saran, cellophane or polyethylene, was compared with 0·0014-inch cellophane and 0·0015-inch polyethylene for resistance to penetration by *Calandra* (*Sitophilus*) *granaria* (L.), *C.* (*S.*) *oryzae* (L.), *Rhizopertha dominica* (F.), *Tenebroides mauritanicus* (L.), *Oryzaephilus surinamensis* (L.), *Tribolium confusum* Duv., *Stegobium paniceum* (L.), *Trogoderma parabile* Beal, *Ephestia kuehniella* Zell., *Plodia interpunctella* (Hb.) and *Blattella germanica* (L.). None of the laminated films was penetrated, whereas 10·5, 61 and 61 per cent. of the packages covered with Mylar, cellophane and polyethylene alone were penetrated in 6, 1·8 and 1·5 weeks, respectively. *Tenebroides mauritanicus* penetrated 12·4 per cent. of the Mylar packages and *R. dominica* and *Trogoderma* 6·2 per cent., the first two requiring an average of five weeks and the last nine weeks. It is concluded that transparent laminated films with Mylar as the outer layer were highly effective in resisting penetration.

Wene (G. P.). **Injurious Insects found on Castor Beans.**—*J. econ. Ent.* **48** no. 1 p. 110, 3 refs. Menasha, Wis., 1955.

Castor beans [*Ricinus communis*] were grown rather extensively in the lower Rio Grande Valley of Texas in 1952, and *Liriomyza subpusilla* (Frost) was found in destructive numbers during the summer in all the plantings examined. By 25th July, mining by the larvae had caused the shedding of approximately two thirds of the leaves in one field, and five leaves selected at random showed an average of 39 fully developed larvae migrating to the

edge of the leaves and ten feeding or ovipositing adults. *Empoasca solana* DeLong was present in large numbers in the Edinburg area on 23rd July, when as many as 39 adults and nymphs were found feeding on a single castor leaf; it had caused 50 per cent. leaf drop in one field. Some 200 acres of castor were infested by *Heliothis zea* (Boddie) (*armigera*, auct.) on 23rd July. Larvae in all stages of growth were present, at least one larva was feeding on each flower or seed spike and 4–5 on the leaves of each plant, and about 75 per cent. of the seed pods had been destroyed.

Duarte (A. J.). **Primeira lista de algumas espécies de insectos de interesse económico em Angola.** [A first List of some Species of Insects of economic Importance in Angola.]—*Agron. angol.* no. 9 pp. 107–120, 1 ref. Luanda, 1954. (With Summaries in French and English.)

This preliminary list is divided into two parts. The first shows the insect pests of various crops (excluding coffee) and stored products in Angola, with notes on the crops, etc., infested, and the insects that are parasitic or predacious on them, with indications of the species attacked, and the second shows the insect pests arranged under the crops concerned.

Hill (E. G.) & Border (B. S. J.). **The Fumigation of a Flour Mill with Methyl Bromide.**—*Milling* 121 pp. 488, 490, 492, 494–495, 3 graphs, 4 refs. Liverpool, 1953.

The following is based almost entirely on the authors' summary. The fumigation of a flour mill with methyl bromide was carried out successfully for the first time in Britain in the spring of 1952 and was repeated at the same period in 1953, following reinfestation from without. The major pest concerned was *Tribolium confusum* Duv., but *Ephestia kuehniella* Zell., *Gnathocerus cornutus* (F.) and *Laemophloeus turcicus* Grouv. were also present. The dosage employed was 20 oz. methyl bromide per 1,000 cu. ft., the fumigation period was 24 hours, and totals of 760 lb. and 750 lb. methyl bromide were used, respectively. The individual floors of the seven-storey building were partly sealed off from one another with the exception of the top two, which were treated as one. Gas sampling tests were carried out during the fumigation and airing periods, and insects collected in the mill were exposed at various points to test the efficacy of the treatments. As a result of experience gained during the first year, the upper three floors were overdosed at the expense of the lower floors during fumigation in 1953, with the result that the distribution of the fumigant throughout the building during the fumigation period was less uneven.

The concentration–time products for the fumigant at all sampling points were well in excess of that considered effective against stored-product pests, and on the basis of the chemical results it was to be expected that the fumigations would be successful. This was confirmed by the complete mortality observed in the tests with insects and by post-fumigation inspections, which failed to reveal any living insects. These results show a considerable improvement on those given by fumigation with hydrogen cyanide at this mill on previous occasions and at other mills of similar construction.

Samples of flour present in the mill during the fumigation were analysed for methyl-bromide residues by determination of increased bromine content. The samples were found to contain appreciable quantities of bromine, which

were not reduced by further airing. The bromine residues were not reduced during the baking of bread from this flour, and a faint transitory sweetish smell was noted when the freshly baked loaves were cut. The flour produced during the first few hours of milling after fumigation showed an increase in bromine content due to contamination with flour present in the mill machinery during the fumigation period.

PAPERS NOTICED BY TITLE ONLY.

BEAL jr. (R. S.). **Biology and Taxonomy of the Nearctic Species of** *Trogoderma* **(Coleoptera: Dermestidae).**—*Univ. Calif. Publ. Ent.* **10** no. 2 pp. [3 +] 35–101, 18 figs., 67 refs. Berkeley, Cal., 1954.

MENEZES MARICONI (F. A.). **Contribuição para o conhecimento do** *Diactor bilineatus* **(Fabricius, 1803) (Hemiptera-Coreidae), praga do maracujazeiro (*Passiflora* spp.).** [A Contribution to Knowledge of *D. bilineatus*, a Pest of *Passiflora* spp.]—*Arq. Inst. biol.* **21** pp. 21–42, **2 pls.**, 6 figs., 27 refs. São Paulo, 1954. (With a Summary in English.) [For shorter account see *R.A.E.*, A **42** 54.]

CALCAGNOLO (G.) & SAUER (H. F. G.). **A influência do ataque dos pulgões na produção do algodão (*Aphis gossypii* Glover 1876, Hom. Aphididae).** [The Influence of Attack by Aphids (*A. gossypii*) on the Production of Cotton.]—*Arq. Inst. biol.* **21** pp. 85–99, 2 pls., 1 graph, 3 refs. São Paulo, 1954. (With a Summary in English.) [For shorter account see *R.A.E.*, A **43** 34.]

LEIDERMAN (L.) & SAUER (H. F. G.). **Resultados preliminares da ação de inseticidas orgânicos no combate à *Heliothis obsoleta* (Fabr., 1793) em espigas de milho (Lepidoptera, Noctuidae).** [Preliminary Results on the Action of organic Insecticides for the Control of *H. zea* (Boddie) (*obsoleta* (F.)) in Ears of Maize.]—*Arq. Inst. biol.* **21** pp. 101–110, 28 refs. São Paulo, 1954. (With a Summary in English.) [For shorter account see *R.A.E.*, A **42** 324.]

LEIDERMAN (L.) & SAUER (H. F. G.). **Ação de alguns inseticidas orgânicos sôbre *Laphygma frugiperda* (Abbot e Smith, 1797) atacando milho (Lepidoptera, Noctuidae).** [The Action of some organic Insecticides on *L. frugiperda* attacking Maize.]—*Arq. Inst. biol.* **21** pp. 111–119, **15 refs.** São Paulo, 1954. (With a Summary in English.) [For shorter account see *R.A.E.*, A **42** 314.]

ROONWAL (M. L.). **A List of Insect Pests of Forest Plants in India and the adjacent Countries, arranged alphabetically according to Plant Genera and Species, for the Use of Forest Officers. Part 1. General Introduction.** BHASIN (G. D.) & ROONWAL (M. L.). **Part 2. List of Insect Pests of Plant Genera 'A' (*Aberia* to *Azima*).**—*Indian For. Bull.* (N. S.) Ent. no. 171 (1), 93 pp., 28 refs. Delhi, 1954.

BRUNE (B. P.) & others. **Collecting, preparing and preserving Insects.** —*Publ. Dep. Agric. Can.* no. 932, 8¼ × 5 ins., 133 pp., 108 figs. [Ottawa] 1955. Price **50 cts.**